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ELECTRIC RAILWAY TRACTION

A Supplement illustrating and describing developments in Electric Railway Traction is presented with each copy of this week's issue.

Mr. Alexander Muirhead

THE recent death of Mr. Alexander Muirhead has deprived Indian railways of one of their most distinguished administrators and chairmen. Based on an abnormally wide experience of operation upon three company-worked and one State system, his administrative and executive knowledge made him particularly well fitted to assume the post of chief executive officer of an important railway, the South Indian, in 1911. After nine years in that position, during part of which he was President of the Indian Railway Conference Association, Mr. Muirhead retired from India, but has for the majority of the subsequent 15 years been the principal directing influence in South Indian affairs, first as Managing Director and later as Chairman and Managing Director. His loss will be keenly felt by a very large circle of friends, but there is some consolation in the fact that his son, Mr. C. A. Muirhead, is following in his footsteps as Agent of the S.I.R. It is, moreover, a great satisfaction to know that the chairmanship has passed into the hands of so able and experienced an administrator, Sir Ernest Bell, and that the board has been completed by the inclusion of one who knows the system so well as the late Agent, Sir Percy Rothera.

The Railway Cinderella

Permanent way has always been something of a Cinderella in the railway world. Without it, of course, the wheels would not turn, but its lowly position, and the subconscious knowledge of its inevitability, have contributed to its almost complete lack of public interest. A popular book about it, even though it includes the structures which carry the track and the buildings which accommodate the passengers in their transition to and from the trains, is therefore to be welcomed, and the Great Western Railway which has sponsored its publication deserves thanks. Among our notices of publications on page 135 will be found one on the latest addition to the series of informative G.W.R. booklets written in popular language, but with general accuracy and authority, by Mr. W. G. Chapman. It is called "Track Topics" and exhibits Cinderella in her party frock. It is a popular contribution to general railway knowledge which is long overdue, and as creditable a production as the other volumes in the Great Western Railway series.

* * * *

The Week's Traffics

Merchandise receipts of the four amalgamated companies have continued to improve, except on the Southern, and their earnings from this traffic for the 29 weeks amount to £28,794,500, a net decrease of only £23,500 or 0·08 per cent. The Great Western and the London Midland & Scottish have aggregate increases of £58,000 and £52,000 respectively, and the L.N.E.R. merchandise decrease has been reduced to £30,000, but that of the Southern is now £103,500. Passenger train earnings are well on the up grade, and the aggregate for the four companies is £35,441,000, an increase of £820,000 or 2·37 per cent. Coal class earnings, on the other hand, are down for the 29 weeks, except for an increase of £9,000 on the L.M.S.R., and amount to £16,831,500, a decrease of £205,500 or 1·20 per cent. Total receipts for the four companies to date aggregate £81,067,000, a net increase of £591,000 or 0·73 per cent.

	29th Week				Year to date.	
	Pass., &c.	Goods, &c.	Coal, &c.	Total.	Inc. or Dec.	
	£	£	£	£	£	%
L.M.S.R.	+ 11,000	+ 7,000	− 4,000	+ 14,000	+ 385,000	+ 1·19
L.N.E.R.	+ 9,000	+ 20,000	−14,000	+ 15,000	+ 37,000	+ 0·15
G.W.R.	—	+ 6,000	− 2,000	+ 4,000	+ 113,000	+ 0·84
S.R.	+ 24,000	− 2,000	—	+ 22,000	+ 56,000	+ 0·52

* * * *

Spoken Publicity

The cheapest and most pervading form of publicity—the unsolicited spoken word—is still far from being enlisted in the service of railways. Making a train journey at short notice in an unfamiliar neighbourhood may require many wasted minutes in the cross-examination of natives who have bus times and stopping places at their finger-tips, but parry queries regarding railway services with a blunt, "what do you want to go by train for?" Experience has taught us that it is wise to conceal or falsify our destination when making inquiries in such circumstances, but we have no right to expect the public in general to be as cunning (or obstinate) as ourselves. The signs erected by the Southern Railway, as recorded in our issue of June 28, to guide intending travellers to stations on the electrified main lines, will save many from being diverted to other means of transport before reaching their goal. We believe that we are not alone in finding the train normally the least troublesome vehicle for covering moderate distances in a strange locality, and a profitable line of propaganda would seem to be to persuade local residents that their best service to an inquiring stranger is to direct him without preamble to the nearest station.

XUM

The Importance of Being Hungry

Now that a question has been asked in the House of Commons regarding an alleged insufficiency of refreshments at a public function, the business of catering seems to have acquired a new dignity. Publicists, from the Epicureans to the Empire Marketing Board, have broadcast injunctions to eat on various pretexts, but it has remained for a Member of Parliament to show hunger as a noble appetite worthy of having the resources of the Constitution enlisted towards ensuring its appeasement. We ourselves, when travelling by train at holiday seasons, have sometimes been unable to win a seat for lunch until as late as four o'clock in the afternoon, and then only to find that certain dishes have dwindled to the insubstantial condition technically described as "off"; but although our sufferings on these occasions have been terrible in the extreme, a misplaced diffidence has hitherto dissuaded us from drawing the attention of the Mother of Parliaments to the sparse furnishings of our internal economy. Henceforth we shall recognise, however, that the eye of the Speaker may be easier to catch than the imperturbable orb, courteous in overlooking what it does not wish to see, of the hard-pressed restaurant car steward.

* * * *

Pullman Incorporated

A restoration of earning power, after a lapse of two years, in both the sleeping car and the manufacturing subsidiaries of Pullman Incorporated is shown in the company's report for the year 1934. In 1933 there was a net loss of $2,672,864, and in 1932 one of $3,834,725, whereas in 1934 there were net earnings of $2,957,670, or 76 cents a share. Marked expansion in the volume of rail passenger travel produced an increase in the gross revenue of the sleeping car business from $39,316,000 to $44,524,000, and the manufacturing business, notwithstanding the continued low volume of new car production, earned with the aid of air-conditioning work a profit of $1,292,591 in 1934, as contrasted with losses of $3,825,077 and $4,074,830 respectively, in 1933 and 1932. In certain regions the removal of the surcharge on Pullman accommodation and a marked lowering of the rail charges for transportation in Pullman cars, which came into force on December 1, 1933, produced a steady improvement throughout 1934 in the occupancy of Pullman cars, but this improvement was not so noticeable in regions where these reductions did not apply. This year the substantial expansion in the number of air-conditioned Pullman cars, improved service, equipment, and accelerations, are expected to increase the appeal of the Pullman services.

* * * *

South Manchuria Railway Report

At the recent annual general meeting of the South Manchuria Railway Company, the report for 1934-35 was presented; it is in Japanese. The total revenue was Y. 270,669,000 and expenditure was Y. 224,201,000, leaving a net profit of Y. 46,468,000—as compared with Y. 42,922,000 last year. In addition, Y. 9,182,000 was brought forward from the previous year, so that the net surplus available this year is Y. 55,650,000. It has been decided to distribute this sum between the following:—

	Y.
Payment of 8 per cent. ordinary dividend,	21,920,000
Japanese Government share	11,350,000
Legal reserves	2,330,000
Special reserves	7,000,000
Directors' bonuses	400,000
Total	43,000,000
Surplus carried forward	12,650,000

Of a sum of Y. 213 million to be spent during the current financial year on various improvements, Y. 50 million are allotted to the S.M.R., Y. 150 million to new State Railways construction works, and Y. 13 million to new industrial investments. A loan issue of Y. 150 million has been approved to cover this expenditure. The President in his speech mentioned that, due to large orders from Japan and Chosen (Korea), and to increased domestic consumption, coal traffic was increasing, but a drop in agricultural produce was to be expected this year. He reported that the Showa Steel Works and Manchuria Chemical Company, both of them under the control of the S.M.R., showed steadily increasing profits, and of the State lines operated by the S.M.R., the North Manchuria system was already showing benefits.

* * * *

A Temporary Railway "Corridor"

The German railway authorities have had considerable experience in endeavouring to solve the problems associated with railway working through a transit corridor between two points on the same national soil but crossing foreign territory *en route*. The Polish corridor is the best-known example of such working, but similar conditions apply on both the Danish and Belgian frontiers in consequence of post-war territorial adjustments. Within the past few days another "corridor" has been created in order to meet the temporary difficulties of the Austrian railway authorities consequent upon a severe landslip which dislocated railway traffic between Leogang and Hochfilzen on the Salzburg-Innsbruck line. The Austrians therefore requested the German authorities to permit the diversion through German territory of all traffic from that section of the main line. Express traffic between Salzburg and the Austrian Tyrol was temporarily routed via Rosenheim, and returned to Austrian soil at Kufstein. As Austrians may not at present travel to Germany without a special visa, which is difficult to obtain, the carriages were sealed at Salzburg and unsealed at Kufstein. We understand, however, that normal working was resumed on Monday, and therefore this new "corridor" had but a brief life.

* * * *

Regaining 23½ Hours

It has now become almost established practice in France, on the night when winter time changes to summer time, to endeavour to carry on the long-distance train-services as if no loss of an hour had taken place. The success with which this vast task of time-regaining is tackled is little short of extraordinary, and witnesses to the value of a time-recovery bonus as a stimulant to meritorious locomotive work. The May number of *Le P. O. Illustré* gives some details of what happened on the Paris-Orleans system during the night of March 30-31, when the time change took place. At midnight thirty *rapides* and express trains which were in motion automatically became one hour late. Seven of them recovered the whole of the 60 min., and arrived at Bordeaux or Paris on time; eight more were less than 10 min. late, and a total of nineteen recovered between 45 and 60 min. The three "worst" examples were 41 to 45 min. late, having recovered only 15 to 19 min. of the loss, and two of these arrivals were at Sète, at the end of lengthy and intricate cross-country journeys. A summary of this remarkable overnight effort gives a total of 23 hr. 24 min. regained in all by thirty trains, which works out at a shade under 47 min. per train. It may be granted that many of these night timings on the Paris-Orleans line are easy, by comparison with those of the day trains, but on the other hand some of the loads hauled are enormous, trains of 600 and 700 tons being common. This applies particularly to such a train as the Pyrénées-Côte d'Argent *rapide*, composed mainly of sleeping cars, which recouped 47 min. from St. Pierre-des-Corps to Bordeaux on the fastest night service timing.

Air-Conditioned Trains to Atlantic City

Most travellers will agree that while inadequate ventilation is a trial on any part of a railway journey, it is particularly burdensome in the hours appointed for eating and sleeping. The Pennsylvania Railroad has therefore concentrated in its summer timetables on the extended use of air-conditioned dining and sleeping cars on its through services to and from Atlantic City, no doubt as the most acceptable measure short of putting on more trains so equipped throughout, like the twice-weekly service now running to Atlantic City from Washington. Air-conditioned sleepers began running on June 22 on the daily through trains in each direction between Chicago and Cleveland and Atlantic City. From June 15 air-conditioning was extended to the overnight service between Atlantic City and Pittsburgh. Air-conditioned parlour buffet cars were introduced on the same date on the Washington-Atlantic City all the year round service, running daily in each direction. Air-conditioned parlour cars are available daily both ways between New York and Atlantic City. American travellers thus enjoy a change of air from the outset of their holiday, instead of regarding the rail journey as a stuffy preliminary to the benefits of a seaside resort.

* * * *

Official Report on Quetta Earthquake

The Divisional Superintendent, Quetta, North Western Railway of India, has issued his official report upon the earthquake which occurred without the slightest warning at 3.3 a.m. on Friday, May 31. The report gives as final figures, 917 deaths among the railway staff and families, and over Rs. 30,00,000 (or £225,000) as the cost of damage to railway property. Its day-to-day account of proceedings in the stricken city makes harrowing reading, but it is obvious that the railway personnel behaved magnificently. The Army Commander, General Karslake, wrote a most appreciative letter of thanks to the Divisional Superintendent for the manner in which the railway staff had stood up to the severe strain placed upon it. One paragraph near the end of the report reads: " It is most satisfactory to record that the railway was at all times able to clear all the passenger traffic offering, and that by June 18 over 30,000 refugees had been evacuated by railway. When considering these figures it is possible to realise the important part the railway has played in this catastrophe . . . " He might well have added, " in spite of so severely depleted staff." Incidentally we may mention that the Divisional Superintendent is Mr. B. C. L. Bean, and not Dean as quoted from *The Times* in our editorial on June 7. There is a senior N.W.R. officer named Dean who might have been there temporarily, and hence the confusion.

* * * *

An Anti-Earthquake Design of Structure

An earthquake such as that which recently razed Quetta to the ground reminds one that many widely-spaced spots upon the earth's crust are liable to quakes: Japan, San Francisco, South America, India, and New Zealand are but a few. Equally wide interest may therefore be expected in any measure which tends to combat this disastrous tendency, and much research work has been and is being carried out in certain countries, notably Japan, with this end in view. The Montalk design of structure evolved by a New Zealand architect of that name is comparatively simple and may be expected to be efficacious. It has been patented, but, according to *Indian Engineering*, in which it is described, Mr. Montalk made a gift of his patent to India after the recent Quetta earthquake. The principle involved is the erection of any structure upon a floating reinforced concrete raft which rests upon a layer of shingle confined within a " dish " of concrete. The latter takes the form of another, heavier concrete raft having an upturned flange, or stout rim, surrounding the shingle layer and therefore of slightly greater internal dimensions than the upper concrete raft. In theory the bottom raft takes the shock, but the shingle absorbs it owing to its comparative fluidity and ability to move under the floating raft, so that little shock is transmitted to the latter and to the structure. We have no information as to whether the idea has been subjected to actual earthquake test or not, but it should certainly prove far cheaper than a complete rigid reinforced concrete structure, and seems worthy of trial.

* * * *

Semi-Streamlining in Germany

The fully streamlined express locomotives recently built in Germany, to which another one will shortly be added, are now to be supplemented by other designs of the semi-streamlined description, the purpose being to see what results can be obtained with a minimum of alteration from the standard in directions most likely to prove effective. During a recent visit to the Borsig works in Berlin we were shown a partly completed 4-6-2 type engine which at first sight appeared to be identical with the standard two-cylinder Pacifics of the Reichsbahn. Closer inspection showed, however, that the smokebox and its internal arrangements were similar to those of the wholly streamlined locomotive built at these works earlier in the year and fully illustrated and described in our issue of March 1 last. In addition, slight modifications are being made in other respects and probably certain of the moving parts may be covered in. It is expected by these measures to reach speeds of 150-160 km.p.h. without difficulty, at the same time making a substantial saving in the horsepower required to move the trainloads involved at those speeds. It is realised that the practice of building wholly streamlined locomotives as a standard type would necessarily entail much increased cost, and engines representing only a relatively moderate departure from standard should be able, with ordinary trainloads, to reach substantially higher speeds than at present in return for a much lower expenditure.

* * * *

Tunnelling the Vosges

Boring of the longest tunnel entirely in France has just been brought to a successful conclusion. Although there are certain longer frontier tunnels, such as Somport, which lies partly in France and partly in Spain, the new tunnel from Lusse, in the Vosges department, to Sainte-Marie-aux-Mines, in Haut Rhin, holds the record for a tunnel entirely in French territory, with a length of 4·35 miles. Work began on June 27, 1933, and the piercing, in which all the resources of modern engineering have been brought into use, has been completed in just under two years, as mentioned in our issue of June 21. Day and night shifts have been employed continuously. The purpose of the new tunnel is to connect the main line of the Alsace-Lorraine Railways, at Sélestat, by way of the existing branch up to St. Marie-aux-Mines, with the line from Strasbourg to St. Die via Saales, which the line from the tunnel will join about 1½ km. from the station of Provenchères-sur-Fave. The supremacy in length of the new bore will be but transient, however, as the Bussang tunnel, which is also now in course of being driven through the Vosges, between Wesserling and St. Maurice, will measure 5·3 miles in length. Both tunnels will greatly improve the railway communications through this natural mountain barrier, and will also have an important strategic value in linking Alsace with the remainder of France.

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London Transport Progress

THE beginning of the present month marked the entry of the London Passenger Transport Board into its third year of operating life, and therefore the present is an opportune moment to review its activities, especially as the annual occasion for such review provided in the case of the main-line railways by the presentation of the annual accounts has not so far arisen with London Transport. When the board was established, it was entrusted with three main tasks, namely, to acquire and consolidate all the existing means of local transport; to establish a pool of passenger receipts with the suburban services of the main-line railways; and to take such steps as were considered necessary for extending and improving passenger transport facilities within its area. The first year of its life was devoted mainly to bringing under one ownership all the local transport units in London and welding them into one undertaking. Actually this task was not quite completed within the space of twelve months, and, in fact, the last independent omnibus proprietor to be acquired—the Prince Omnibus Co. Ltd.—was not taken over until December 5, 1934; but the outstanding concerns at the end of London Transport's first year were few and comparatively unimportant. During the second year, now just completed, the outstanding event has been the establishment of the pool of passenger receipts with the main-line railways. As we have previously pointed out, the preparation of this as an agreed scheme was a triumph, not only of accountancy, but also of commercial give-and-take, carried out by all the parties in a spirit of helpfulness. The minor modifications required by the London Passenger Transport Arbitration Tribunal were concerned more with methods of presentation than with fact. When the pooling scheme was confirmed by the tribunal on June 18 last, it fixed the final percentages for the pooled receipts as follow:

L.P.T.B.	62·00473
G.W.R.	1·33541
L.M.S.R.	5·09340
L.N.E.R.	6·01488
S.R.	25·55158
Total main-line railways	*37·99527*

London Transport thus entered its third year with what may be considered its preliminary tasks in the main completed, and the efficiency with which they have been performed is sufficiently indicated by the fact that already it has been found possible to take important steps in respect of the third stage of development, namely that of extending and improving facilities. The £35,000,000 scheme for which the Government is guaranteeing both the principal and interest would not have been possible in a competitive era. Full details of the scheme have already been published in our columns, but for ready reference two maps are included in the *Electric Railway Traction Supplement* which accompanies the present issue. These show the works to be undertaken, and have been revised in accordance with the latest information available. In the field of road transport the most spectacular development now being carried out is the conversion of tramways to trolleybus routes. Last year Parliament sanctioned a scheme embracing some 90 route miles and a further 58 miles were included in London Transport's application to Parliament this year. On the routes already authorised a considerable amount of conversion work is already being carried out, and it is hoped that by the end of the present calendar year trolleybuses will have replaced trams on routes between Woolwich, Bexley, Erith, and Dartford; Crystal Palace, West Croydon, and Sutton; and Shepherd's Bush and Hammersmith, and Hounslow and Hampton Court. For these services a fleet of 120 trolleybuses has already been ordered.

Up to the present complete financial results of the board's operations have proved impossible to prepare, and Parliament has sanctioned an extension of time for the presentation of these until the end of August, or such later date as the Minister of Transport may think fit to authorise. The board owns 174 route miles of railway and at present works its trains over 227 route miles, but the latter figure will be increased considerably when the present electrification and improvement schemes are completed. In the area over which passenger receipts are pooled with the main-line railways, there are in all some 900 railway stations. As the result of taking over 17 tramway undertakings the board owns 324 route miles of tramway and 18 miles of trolleybus route. In all, the whole or part of some 160 undertakings have been brought under the ownership of London Transport, but of this figure 126 were small or moderate-sized motorbus concerns. A fleet of about 13,000 passenger vehicles has been assembled, of which roughly 4,000 are railway rolling stock, about 6,300 buses and coaches, and 2,500 tramcars. London Transport conveys approximately 3,400,000,000 passengers per annum, and the main-line railway companies some 500,000,000 local passengers within the area.

* * * *

Colonel Mount's Annual Report

CONTRARY to the usual practice, we are prefacing our remarks on Colonel Mount's report, Cmd. Paper 4943, on the railway accidents of 1934, with the summary table with which that report concludes. It is as follows:—

Particulars	Annual Average, 1920-24		Annual Average, 1925-29		Year 1932		Year 1933		Year 1934	
Accidents to trains	1,009		941		739		760		810	
Accidents to or failure of rolling stock or permanent way	11,153		9,141		5,381		5,156		4,958	
Casualties:—	*K.*	*I.*	*K.*	*I.*	*K.*	*I.*	*K.*	*I.*	*K.*	*I.*
Passengers	92	2,577	91	3,733	77	4,044	70	4,716	85	4,886
Servants	248	3,518	210	3,267	170	2,385	163	2,487	216	2,398
Other persons	67	136	67	158	60	130	49	145	35	147
Totals	407	6,231	368	7,158	307	6,559	282	7,348	336	7,431
Passenger journeys, including estimates of those of season ticket holders (millions)	1,848		1,661		1,557·0		1,574·6		1,638·6	
Freight tonnage (millions)	322		320		269		269		289	
Net ton-miles (millions)	17,457		17,562		14,942		15,026		16,219	
Companies' servants employed (March)	707,574		680,197		599,290		567,554		576,362	
Passenger and freight train mileage (millions)	368·7		401·3		405·2		412·3		427·5	
All casualties per million train miles:—										
Killed	1·1		0·9		0·8		0·7		0·8	
Injured	17		18		16		18		17	

It will here be seen that the number of accidents reported was higher than in the two previous years. The explanation, we suggest, lies in the increased traffic recorded under the fourth and fifth headings of the table. In the accident returns found farther on in the report it is seen that the number of collisions, 256, whilst higher than in 1933 and 1932, was lower than the annual average for the years 1925-1929, whilst the derailments, 162, were less numerous than in any year shown in the report. Further, the total of 810 accidents of all kinds becomes less impressive when it is noticed that 334 of these were cases of trains running into obstructions. That figure has been fairly constant since 1924. What is significant about this total of 810 accidents is that the Ministry of Transport found it politic to hold formal inquiries into only 11 of them; there were also 5 accidents which were inquired into by, we presume, correspondence. In four of the 16 cases the fault lay with the driver, in three with signalmen, in one a ganger failed to observe the regulations as to the use of an occupation key on a single line, and in three cases there was carelessness of road vehicle drivers when traversing level crossings. Recommendations were made by the Inspecting Officers in 13 of the 16 cases; they were adopted, wholly or in part, in seven instances, not adopted in one, and in the remaining five the matters are still under consideration. Automatic train control would have prevented the collision at Doncaster, and track circuit—since installed—those at Camden and Winwick Junction. The reports on these three accidents were reviewed in our issues of August 24 and June 15 of last year and of January 11, 1935, respectively. It is not recorded what has been done following the recommendations made in the Freshfield and Wormley occupation level crossing accidents (see our issue of March 1, 1935).

The number, 4958, of accidents to or failures of rolling stock or permanent way was, it will be seen, the lowest in the whole of the period covered by the report and, apparently, had not been adversely affected by the increased business of last year. A yet more gratifying feature is that the failures of couplings—always the predominant figure—have fallen year by year from an annual average of 10,675 for the years 1926-1924 to 4,679 in 1934. "The decrease," says Colonel Mount, "is satisfactory as indicating that steel of increased strength and better quality is being employed." The increase in the fatalities to passengers is accounted for by the six passengers killed at Port Eglinton Junction and the eleven at Winwick Junction, in comparison with a total of six in 1933 and four in 1932. That fact puts the number of passengers, 68, killed in "movements" accidents in a better light, as whilst it compared with 64 in 1933, it was lower than in any other year covered by the report. In that matter Colonel Mount remarks that these "were, as usual, mainly due to misadventure or to carelessness or misconduct on the part of passengers themselves, the principal causes being entering or leaving trains in motion, crossing the lines at stations, opening and closing of carriage doors and falling from carriages or platforms. The figures have been increasing for some years and it would seem that education propaganda to induce greater care affords the only means by which the number of such accidents may be reduced."

The total number of servants killed was 216. It is to be regretted that 12 of these were in train accidents, which figure was the highest for any year shown in the report. Three of these were in the Port Eglinton Junction accident, one in the Winwick Junction, one was the ganger who irregularly used the occupation key on a single line, and two were in the Wormley occupation level crossing derailment. There is nothing in the report to identify where the other five were killed, but in table No. 3 of the returns there is shown one servant killed in a collision between freight trains or parts of freight trains on some other railway than one of the main lines, L.P.T.B. lines or a joint line; there were four caused by trains running into obstructions, and one, on the L.M.S., to the "failure of engines through bursting of boilers, tubes, &c." The number of servants killed in "movement" accidents was 204 out of the total of 216. That figure was not only higher than the 152 of 1933 and 167 of 1932, but more than the 201 of the annual average for the years 1925-1929. One outstanding satisfactory feature of this class of accident is that the number of fatal accidents whilst shunting, 33, was, despite the increased tonnage handled, less than in 1933 and less than in any year covered in the report. On the other hand, the 63 killed whilst working on the permanent way was almost double the number, 32, so killed in 1933, and is above the average. The 80 fatalities to men when walking or standing on the line on duty or when proceeding to or from work was the worst since the average of 87 for the years 1920-1924. Colonel Mount closes his report by remarking that the 427·7 millions train mileage was the highest since the war period and that it affords a reasonable basis on which to compare the general incidence of accident and casualty. He then adds the following important conclusion: "In view of the increased number of fatalities during the year, and bearing in mind increasing train-mileage and speed, I conclude by directing serious attention to the risks attending the presence of workmen on the line and to the necessity for maintaining educational endeavour to ensure obedience to rules, which have been framed with the sole object of promoting greater care and personal safety."

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The Electrified Tauernbahn

POST-WAR Austria is faced with many and peculiar problems as the result of the splitting-up of the Austro-Hungarian Empire. One difficulty results from the paucity of mineral wealth, in particular the absence of coal, and this has resulted in the extended use of electricity. The latest development in this direction is the inauguration of electric traction over the southern section of the Tauernbahn. This was completed in time for through services to be worked electrically with the introduction of the Continental summer timetables on May 15 last. The equipment of the new line forms the subject of an illustrated article by Ministerialrat Ing. Ernst R. Kaan, Director of Electrification of the Austrian Federal Railways, which appears in our *Electric Traction Supplement*. The line in question provides one of the most important north to south links in that part of Europe, as it completes railway communication between Salzburg (which is a "collecting point" from central Europe) and the Mediterranean ports of Trieste and Fiume. The construction of the northern section of the route from Schwarzach—St. Veit to Badgastein was begun in 1903 and completed in 1905, while the southern section from Badgastein to Spittal-Millstättersee was opened in July, 1905. In 1930 the electrification of the line was begun; the portion from Schwarzach-St. Veit to Mallnitz was opened to electric traffic in December, 1933, and the remainder of the work was accomplished by April, 1935. From an engineering point of view, one of the main obstacles which had to be overcome in building the line was the massive mountain range of the High Tauern, which presented a problem solved only by driving a tunnel 5 miles 555 yd. long. The difficulties encountered in the building of the railway are evidenced by the fact that over the total length of the line (50 miles) it was necessary to construct 17 tunnels measuring together 9 miles 196 yd. There are no fewer than 260 culverts and 34 viaducts. Except on the 7¼-mile section

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between Böckstein and Mallnitz, which includes the Tauern tunnel, the line is of single track. It reaches its highest point (4,022 ft.) in the Tauern tunnel; on the north side of the range it attains an altitude of 2,083 ft. and on the south 2,251 ft. In order to guard against the danger from avalanches huge barriers have been erected at heights of about 6,000 ft. at certain points on the route. The Tauernbahn therefore provides a line particularly suited to electric traction, and members of the Institute of Transport party which visited it on May 30 were particularly impressed by the merits of electricity on a line of such scenic beauty, apart from technical considerations.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Tail Lamps

Westminster, S.W.1.
July 20

To the Editor of The Railway Gazette

Sir,—In connection with your editorial on the above subject in your issue of July 19, it may interest you to know that as far back as 1898 the majority of the passenger brake vans on the Eastern Bengal State Railway were fitted with gas side and tail lights, which were of such a power that they could be seen for at least three miles in clear weather. Drivers reported at the time that they were a very great advantage and when commencing fitting, they asked that complete equipment might be pressed forward with all speed.

I do not know what has happened since 1902, as I presume that gas lighting on that line is obsolete and should like to hear from anyone knowing the situation, what has happened. C. M. E.

[For the past 25 years or so, electric side and tail lights have been standard on this and other systems in India. They have proved entirely satisfactory and are used almost universally throughout that country. Excellent warning to drivers and shunters, and indication to signalmen are given by them. They are run off the ordinary train lighting system.—Ed. *R.G.*]

A Remarkable Locomotive Crankshaft

Montevideo.
June 27

To the Editor of The Railway Gazette

Sir,—The crank axle of which you reproduce a photograph in your issue of May 31 is remarkable not only for the exceptionally long mileage it has accomplished, but especially for such mileage having been attained by an axle having features not usually conducive to such a long life. In the first place it is a crankshaft of a double-framed locomotive, and it has always been held—generally with good reason—that either unequal fore-and-aft " give " in the frames or severe vertical inequalities in the spring-borne weights caused irregular and overstraining effects leading to the propagation of fatigue cracks at an earlier stage than would otherwise occur.

The second point is that the crank webs are not " banded " or hooped; a third that no security bolt passes through the centre of the big-end journal; and fourthly the big-end journals have flat surfaces (of course with well-rounded corners) and not the semi-circular form which is generally to be found associated with extremely long-lived crank axles. There is an even further point in that from the conditions of the country in which the axle has worked, presumably overheating of bearings (particularly big-end journals) due to grit picked up from the track has tended to be more frequent than usual. It would therefore be interesting to know what has been the percentage reduction on the original sizes of the bearings.

It is not possible to observe from the photograph whether the centre portion of the axle has a key-way. If so then the case is more remarkable still because it forms a classic instance of a crank axle having, as regards its form, all the features generally considered disadvantageous. It appears that the thickness of the inner crank webs is less than that of the outer ones and this is not an infrequent feature; in this case it may have had something to do with the long life of the axle, because, in dealing with a double-framed locomotive in which the weight of the engine is distributed (although somewhat unevenly) on *both* sides of each wheel-seat, the centre portion of the axle may have a relatively large amount of flexibility without suffering the effects of fatigue therein arising from the reversal of stress. P. C. DEWHURST

Statistics of Locomotives Under Repair

London (on leave).
June 16

To the Editor of The Railway Gazette

Sir,—In the annual railway statistics published in accordance with the requirements of the Ministry of Transport and analysed in your *Financial and Operating Results Supplement* of April 26, I notice that 7 per cent. of the locomotive stock of the British railways is " under and awaiting repair." Such a classification appears somewhat inexplicit, and might be taken to include, for example:—

(*a*) Light shed repairs.
(*b*) Adjustments in divisions necessitating temporary withdrawals from traffic.
(*c*) Simple cases of dropping a wheel for the inspection of journal and brass.
(*d*) Periodical inspections.
(*e*) Periodical boiler inspections.

It would be interesting to know whether there is any official Ministry of Transport definition specifying precisely what is and what is not to be included in this figure.

Yours faithfully,
N. W. PORTEOUS

[The figures of locomotives under or awaiting repair at the end of the year shown in Statistical Return 11 of the railway companies' annual accounts refer to those in the shops or waiting to go into the shops. They do not, therefore, include locomotives which are simply undergoing shed repairs. Consequently the answer to the possibilities raised under headings *a*, *b*, *c*, *d* and *e* is in each case " no." There are definite instructions as to what is to be included in the annual accounts under this heading, but they are regarded as private and not for publication. The Railway Companies (Accounts and Return) Act, 1911, sets out the statistical returns which are to be embodied in the railway companies' annual accounts, and the 8th Schedule to the Railways Act of 1921 sets out the supplementary statistical information to be supplied by the companies. In both of these Acts returns are to be rendered in respect of the construction and repair of rolling stock under the 1911 Act annually, and under the 1921 Act half-yearly.—Ed. *R.G.*]

L.M.S.R. Stanmore Branch Improvements.—In order to cater for the rapid development of housing estates between Wealdstone and Stanmore (Middlesex), the L.M.S.R. is carrying out a scheme of improvements on the branch line between these points. It is proposed to run trains at 10-minute intervals during the rush periods, and to enable this to be done a crossing loop is being provided at the intermediate station, Belmont, and alterations are being made in the signalling arrangements. The branch is single-track, and the installation of the loop at Belmont will enable trains to cross there. The existing Belmont station will be replaced by a new station of the island platform type, with centrally-heated waiting rooms; the booking office will be at road level near Kenton Lane Bridge. The work will be carried out in stages without interfering with the running of the present train service, and will, it is hoped, be completed before the end of the year.

PUBLICATIONS RECEIVED

Electrician Annual Tables of Electricity Undertakings, 1935. London: Benn Brothers Limited, Bouverie House, Fleet Street, E.C.4. 12 in. × 9¾ in. 250 pp. Limp cloth. Price 10s. net.—In addition to the annual revision of this important reference work, the publishers have this year made a new contribution to its appearance by having it re-set in sans serif type, whereby it gains much in legibility. The general arrangement remains as in previous issues, with tables of British undertakings and power companies (arranged alphabetically and covered by an index giving all places and districts supplied), of Empire and foreign concerns. Concise details of output, distribution systems, types of lamps for public lighting, and charges, are included. A preliminary section is devoted to the national power scheme, showing the selected stations, their owners, and tariffs, with a complete map of transmission lines.

Track Topics. By W. G. Chapman. London: Great Western Railway, Paddington Station, W.2. 7¼ in. × 5 in. 259 pp. Illustrated. Price 1s.—This is the sixth of the Great Western Railway's "Boys of All Ages" series of publications, of which the first five were entitled *The 10.30 Limited, Cheltenham Flyer, Caerphilly Castle, The "King" of Railway Locomotives,* and *'Twixt Rail and Sea.* They are all from the pen of Mr. W. G. Chapman, and the latest addition, which, as its sub-title of "A Book of Railway Engineering for Boys of All Ages" suggests, deals comprehensively with permanent way in its wider sense, is no less creditably produced and comprehensive than its predecessors. The text is in narrative form, divided up as a series of short talks, appropriately beginning with a brief biography of Brunel, that remarkable early engineer for whom difficulties seemed not to exist at all. An illuminating glimpse of the possibilities of applied science when mechanical engineering was in its infancy is revealed by the record of an invention which enabled ten men to do work hitherto necessitating the labour of 110. During the hundred and more subsequent years the expansion of capital equipment has been sufficient to give employment to the majority of the population, but the instance just quoted indicates how inevitable it must be that eventually labour-saving machinery will increasingly displace labour. Succeeding "talks" deal with the broad gauge, the building of bridges, tunnels, viaducts, and other constructions coming within the broad term of the permanent way, the maintenance and renewal of such structures and, of course, the actual track itself. So lucidly written and generally accurate is this little book that we have scarcely been able to find anything at all to criticise adversely. We note that the 102·3 m.p.h. record of 1904 is still claimed, despite the subsequent doubts which have been cast upon it, but probably this is of little importance in view of subsequent high speed runs that have far eclipsed that early effort, whatever its actual figure may have been. We offer the hint that the description of the transition curve might have been shortened by simply calling it a spiral. Those of our readers who have been studying the series of articles in our pages on permanent way maintenance by Colonel Hull will be specially interested in the section dealing with slips in cuttings and embankments. This book is a welcome addition to railway literature, and there is little doubt that it will be as widely read as its predecessors.

Universal Directory of Railway Officials and Railway Year Book, 1935-1936. London: The Directory Publishing Co. Ltd., 33, Tothill Street, S.W.1. 9 in. × 5½ in. × 1¼ in. 580 pp. Price 20s. 0d. net.—This year the date of publication of this valuable handbook has been altered to July so that the financial results for the calendar year 1934 may be included for all the chief railways of the world. The currency of each edition has thereby been extended to as near the full twelve months as is possible, and users should benefit by having fewer manuscript alterations to make during the year. Nevertheless, changes in railway officials are unavoidable, and a practice already much appreciated by subscribers has been continued, namely, printing the text portion on paper that can be written on in ink. The present edition, dated 1935-1936, is the forty-first to be issued. It follows generally the style adopted two years ago when the "Railway Year Book" was incorporated with the "Universal Directory of Railway Officials."

Rapid changes in many parts of the world have necessitated the complete overhaul of various sections; in particular the increasing development in the electrification of main-line steam railways has resulted in extensive revision of the tables detailing steam railway conversion throughout the world. Information secured by a special questionnaire is embodied in a new table of the world's railway mileage showing gradual development in ten-year periods from 1840 to 1930, as well as current total, and State-owned figures. The figures are not strictly comparable by reason of: (*a*) changes in political boundaries (although progressive figures within the present boundaries are given where possible); and (*b*) divergencies in practice as to inclusion of light railways, secondary lines, steam tramways, and interurban electric lines. The general arrangement of the volume follows the scheme adopted two years ago of differentiating between large and small railway systems; beginning the entries of the former at the top of a page; and including a concise description. With the smaller railways it has been found that details of length, gauge, locomotives and rolling stock, and chief officials are all that are generally required in a book of this character. The arrangement of the work is on a geographical basis, and the order in which the entries appear has been selected so as to group all the railways in the United Kingdom, the British Colonial Empire, and the Dominions in sequence, followed by the railways in foreign countries in which important British interests are held, and lastly the railways of other foreign countries.

Boiler Cleaning Tools.—Boiler cleaning tools of a variety of representative types, and designed for manual, water, air, steam, and electric operation, are illustrated in this catalogue from Babcock & Wilcox Limited, London and Renfrew. Hints on the care of and use of such equipment accompany the detailed specifications. In addition to cutting tools for clearing internal scale, a vibrator cleaner is supplied which taps the interior of the tubes and loosens exterior deposits. Cutter heads, built on lines which facilitate repair, are available in a wide range of patterns. For use with the electrical equipment various types of brushes and polishing mops are supplied. The final section of the catalogue lists hand scrapers, cleaners, and milling tools, as well as tube cutters, chisels, and expanders. The boiler cleaning requirements arising under all normal conditions are catered for by this catalogue from a firm which claims to have 188 million sq. ft. of heating surface in land type boilers, and 26,600,000 sq. ft. in marine patterns, in use or on order throughout the world.

The New R.I.B.A. Building.—Under this title the British Steelwork Association, Artillery House, Artillery Row, Victoria Street, S.W., has issued a booklet describing the use of steel in the new headquarters of the Royal Institute of British Architects, opened on November 8 last. The building is steel framed, this method of construction having been adopted to allow of a large internal space free from stanchions, which is now the banqueting hall, and also to accommodate further storeys if required. The banqueting hall is situated above the large foyer, and the two together cut the core out of the building. It was therefore necessary to have walls of great rigidity, which is provided by the steel girders without increasing their thickness, or that of the floors. The booklet is well produced on art paper, with a number of illustrations and diagrams showing the building in course of erection and the mechanical principles followed in the design. The latter are also clearly expounded in the text. Two views of the interior as now finished are included. It is emphasised that steel framing leads to architecture of the highest quality, since exacting structural requirements are fulfilled without prejudice to appearance.

XUM

THE SCRAP HEAP

Friedrich List, the famous German railway pioneer

Friedrich List was born at Reutlingen, Württemberg in 1789, gifted with the spirit of imagination and foresight. Of him Treitschke, the historian, wrote :—

The railway lines proposed down to his time had merely been intended to serve the immediate interests of certain towns or localities. It looked as if the Germans were to be prevented from making a far-seeing use of that great invention, the railway, by the particularist ideas which prevailed among them. Then Friedrich List came forward with a co-ordinated plan for a railway network covering the whole of Germany and, by largely aiding in bringing one main line to completion, demonstrated that his ideal, almost beyond the grasp of most of his contemporaries, was capable of realisation. As the pioneer of the German railway system List deserved well of his country and won his place in the history of her achievements. In working, as he had done years before, for a German customs union, he had spoken boldly only what the majority of his countrymen already felt, but in the realisation of which many fruitless steps were made. In the case of his railway schemes he was far in advance of all his contemporaries in Germany, and never faltered in his belief in the soundness of his prophetic vision. With comparatively little learning, but rich in the experience of life, he stood out above all contemporary writers on economic questions.

List began life as a clerk in the Civil Service, and not long after obtained a post at Tübingen University, but held it only one year. Travelling in South Germany he became impressed with the absurdity of, and inconvenience caused by, the prevailing customs arrangements, and became an energetic leader in the agitation for a German *Zollverein*. Later on, during his railway activity, he said that a customs union and a national railway system were the " siamese twins " of German progress.

Becoming deputy for Reutlingen, he was involved in a charge resulting from his outspoken criticisms of officialdom, and eventually had to quit Württemberg. He went to America, largely at the suggestion of Lafayette, whom he had once known in Paris, and settled at Reading, Pa., where he was well received and where he prospered. In 1827 he published a noteworthy volume on political economy. He became associated with the mining industry and the building of a railway to convey coal from Tamaqua to Port Clinton.

List kept his love of Germany in the New World. His thoughts were always returning to her and the idea of a planned system of railways for that country took firm root in his mind. He realised the difficulties in the way and declared that although a return home was ever in his view, he felt that the pettiness of the small state system would only anger him.

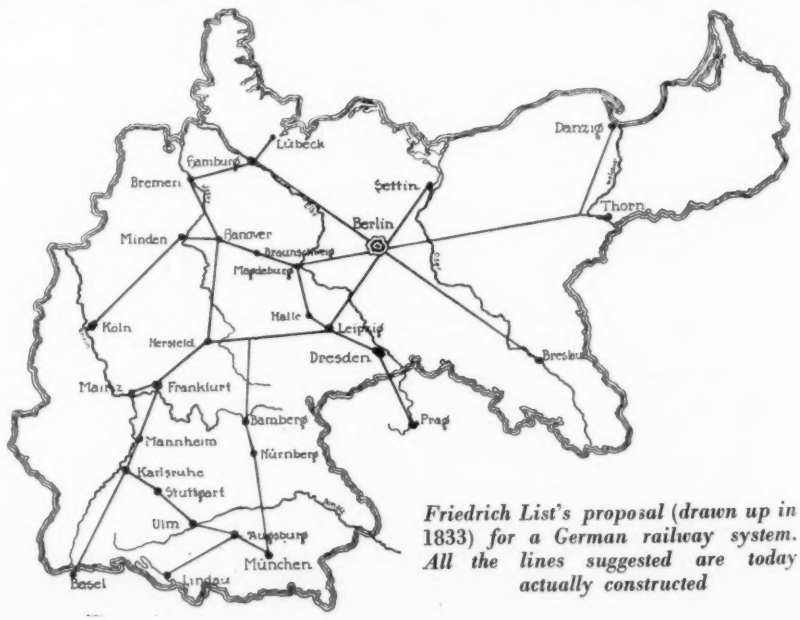
An opportunity to go back soon presented itself. President Jackson selected List to go on a mission to Europe in connection with the establishment of trade relations between America and Continental countries. After returning from this work List went back again to Hamburg, as consul for the U.S.A., in 1832. There he found his railway ideas smiled at, so he turned elsewhere for support. He had already outlined a plan, shown on the accompanying map, for a German railway system, and for various reasons, looked on Leipzig as the most suitable city for the starting point of the first section. Arrived there he issued 500 copies of a pamphlet, " A railway system for Saxony as the foundation of one for all Germany." The conditions for the forming of a company were outlined therein and it is interesting to see that List saw the absolute necessity of conferring on all such undertakings the power to acquire property compulsorily. The pamphlet awakened great interest, and a committee was formed, including Gustav Harkort, brother of Friedrich, his contemporary advocate of a national railway system.

The story of the Leipzig-Dresden railway, opened throughout in 1839, is too long to be told here. It must suffice to say that List, for some reason or other, probably jealousy, gradually received a cold shoulder and was left out of the undertaking, receiving a very meagre compensation for all he had done. This left him in difficult circumstances, as his property in America had greatly fallen in value not long before. Gustav Harkort, who owed nearly everything to List, declared his ideas to be " fantastic absurdities." But List was not yet discouraged. He tried to interest the King of Prussia, but unsuccessfully, in a line from Magdeburg to Leipzig. He also sought to make a line from Frankfort to Basle.

In 1835 List founded a paper called the *Eisenbahn Journal* and wrote that, " The preparation of a general German railway system is the object of this journal and the editor will therefore make it his special endeavour to present correct views on the use of railways, the most suitable form of construction for them and the best routes. He will make clear the characteristics of the latter, as they affect the traffic, the localities, cost of construction and working, and their carrying capacity, while offering advice to all those interested in the subject."

Notwithstanding his energy, to which this announcement bears witness, List did not make a success of the venture, largely because the journal was prohibited in Austria in 1837, causing him to lose many readers. After a short stay in France, he interested himself in the proposed route of the Halle-Cassel line, which he succeeded in modifying so that it was made to serve the principal Thüringen towns, and was also active in advising on some Bavarian lines. In 1841 he brought out another work on political economy.

With all these occupations List had, however, acquired very little means, and gradually declining health made him extremely despondent. He had, he told a friend " lost all his possessions in his endeavours to promote the greatness of Germany." In great mental and bodily suffering he set out for Merano, but a nervous breakdown resulted and he committed suicide near Kufstein, on the extreme southern frontier of Germany, in November, 1846. So ended the career of one whose ambition was to see a unified German railway system. Such now exists, and the lines proposed by List have all been constructed. Persecuted in his lifetime, he has been honoured since, and a monument to him has been erected at Leipzig, while a Friedrich List Foundation has been formed to edit and promote the study of his works, as well as to encourage the development of railway science and economics in the spirit in which he undertook the same task.



Friedrich List's proposal (drawn up in 1833) for a German railway system. All the lines suggested are today actually constructed

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

INDIA

Railway Agents to Meet

It is understood that a meeting of railway agents will shortly be called by the Railway Board to discuss ways and means to check the fall in goods earnings on railways.

Mysore Railway Publicity

It was recently announced in the Mysore Legislative Council that the Mysore Government had decided to stop the annual grant of Rs. 1,500 to the Indian State Railways Publicity Bureau for the inclusion of the Mysore Railways in the publicity programme of the bureau. The Mysore Railways will, in future, do their own advertising. This progressive Indian State has a Trade Commissioner in England.

Dispute Over Railway Management

A long standing dispute between the South Indian Railway and the Tinnevelly District Board over the management of the Tinnevelly-Tiruchendur Railway will be discussed between the Madras Government and the Financial Commissioner of Railways on the arrival of the latter at Ootacamund. The Tinnevelly-Tiruchendur Railway is owned by the District Board and worked on behalf of the owners by the South Indian Railway. The terms of the working agreement constituted a subject of controversy from the very beginning. The South Indian Railway considers that 55 per cent. of the gross earnings payable to it as working expenses is inadequate and is asking for 75 per cent. Other points in dispute relate to junction charges and rate of interest on capital. The present agreement expires next autumn and both the Madras Government and the Railway Board are endeavouring to bring about a settlement of the points in dispute.

Rolling Stock Programme for 1936-37

The Standing Finance Committee for Railways met at Bangalore on July 4 and 5 with Mr. P. R. Rau, Financial Commissioner of Railways, in the chair, and approved of the rolling stock programme of the Indian railways for 1936-37, prepared by the Railway Board in consultation with the various railway administrations. The programme involves an expenditure of Rs. 300 lakhs (£2·25 millions). Details of the programme are not yet available, but it is gathered that a lively discussion took place over the placing of orders for wagons. Last year a substantial portion of the Indian railway requirements in wagons had to be ordered abroad on account of the comparatively high prices quoted by Indian manufacturers. A proposal to invite open tenders in India for half the number of wagons required and to manufacture the remaining half in railway workshops was negatived by the committee. It was ultimately decided that tenders for the total requirements should initially be called in India and that if the prices tendered compared unfavourably, fresh tenders should then be invited from manufacturers abroad.

Quetta Earthquake Railway Casualties

In his official report [upon which we have noted editorially on page 131, ED., *R.G.*], the Divisional Superintendent, North Western Railway, Quetta, gives as final figures the following casualties among the railway staff: —Deaths 137 (or 10 per cent. of the whole staff), and 780 members of their families, so that 917 in all perished. Few survivors escaped without serious losses among their families, and hundreds were seriously injured. Three sons of railway officers were killed.

Car Festival

The Juggernaut Car Festival at Puri began on July 2, and will be concluded on July 10. The large number of pilgrims that left Howrah for Puri towards the end of June necessitated the running of two special trains on June 28 and one on June 29. Additional accommodation had also to be provided on all the scheduled trains to Puri for days ahead of the festival. Special arrangements were made for the transport of pilgrims from Kharagpur. Both the railway and civil authorities have taken great care to prevent the outbreak of epidemic diseases at Puri on the congregation of a vast assembly of pilgrims from all parts of India. So far the festival has proceeded without any serious trouble.

Railway Staff Problems

The half-yearly meeting between the Railway Board and the All-India Ralwaymen's Federation was held at Simla during the last week of June, and a lengthy joint statement of the proceedings has been issued. Sir Guthrie Russell, Mr. P. R. Rau, Mr. Tylden Pattenson, and Dewan Bahadur Mathradas represented the Railway Board at the conference, and Messrs. Mehta, Giri, and Guruswami spoke on behalf of the federation. The subjects discussed included the extension of the hours of employment regulations; the substitution of departmental labour for contract labour; uniform minimum standard of labour policy for all railways; the employment of women doctors in railway hospitals, and other matters relating to the improvement of the conditions of the service of railwaymen. During the meeting, the Chief Commissioner of Railways expressed his sympathy for the railwaymen and their families who were killed or otherwise affected by the Quetta earthquake: the Board was trying to do its best to alleviate the distress of the railwaymen affected. Sir Guthrie praised the conduct of the railway staff in the earthquake area. The meeting ended in complete understanding and good spirit.

FRANCE

Goods Transport Co-ordination

In the French rail and road co-ordination plans, little progress has been made hitherto with the problem of goods transport. As a result of the Government's economy campaign this matter is now being tackled in earnest. A comprehensive administrative regulation bringing the co-ordination of goods transport within the framework of the law of April 19, 1934, has just been voted by the Conseil d'Etat. The new regulation deals with the public transport of goods to the exclusion of private transport. Horse-drawn vehicles do not come within the scope of the regulation. Provisional cards are to be issued for all other vehicles engaged in the public transport of goods. All co-ordination agreements necessitated by the provisions of the law of April 19, 1934, must be concluded before January 1, 1936, between the railways and goods transporters whose vehicles have been provided with provisional transport cards. The agreements will expire on December 31, 1941.

Local Transport Organisation

Under the regulation, a plan for the organisation of goods transport is to be drawn up by the technical co-ordination committee of each department of France. This plan must determine what railway lines or sections of lines are to be completely closed to goods traffic. For the lines kept open to goods traffic, the plan must give: (*a*) a list of the stations entirely closed to goods traffic or to traffic other than complete wagon loads; (*b*) a list of stations kept open to all goods traffic; and (*c*) a list of stations to be known as " centre stations " for goods traffic. In regard to secondary lines, the technical committee's plan must determine the allocation to road transporters of goods traffic abandoned by the railway companies. Public transporters of goods will receive a " public transport card " for each of their vehicles and they will pay a duty calculated as indicated by the regulation. The vehicles and also their contents must be insured against risks of fire, loss and damage.

Small Demand for Rolling Stock

Railway rolling stock manufacturers in France are hard hit by the trade depression and the competition of other means of transport. The serious condition of affairs is described in a report presented at the general meeting of

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" La Chambre syndicale des Fabricants et des Constructeurs de matériel roulant " on June 28. The report shows sharp declines in home and foreign sales. In the home market, orders placed by the principal railway systems have fallen from fr. 1,150 million in 1929 to fr. 102 million in 1934. For locomotives alone the numbers of engines ordered fell from 281 in 1929 to 14 in 1934. In 1929, contracts were given for 17,145 wagons and vans, but in 1934 the number was only 380. This dearth of contracts, according to the report, is due to the financial difficulties of the railways, and some of the causes are traced to the present operating conditions. Railway wages now consume more than 63 per cent. of the receipts, whereas before the war the wage bill was only 36 per cent. The increase in wages is even greater than appears from the figures when account is taken of various advantages such as allowances for large families, pensions, free travel and paid holidays.

Railway Workshops Attacked

The report points out that the railway workshops are obliged to provide work for railwaymen at high wages, while taking work from men in private industry. In this connection the report asks whether the costs involved in running the railway workshops are not excessive or whether the policy of upkeep and repairs of rolling stock as now practised does not cost more than the purchase of new equipment. Under this system, rolling stock is never scrapped and when upkeep work proves insufficient to keep men employed, new construction is undertaken and private industry deprived of a large part of the orders on which it should rightly count. In these circumstances, the railway deficit is increased because there is no appeal to competitive prices.

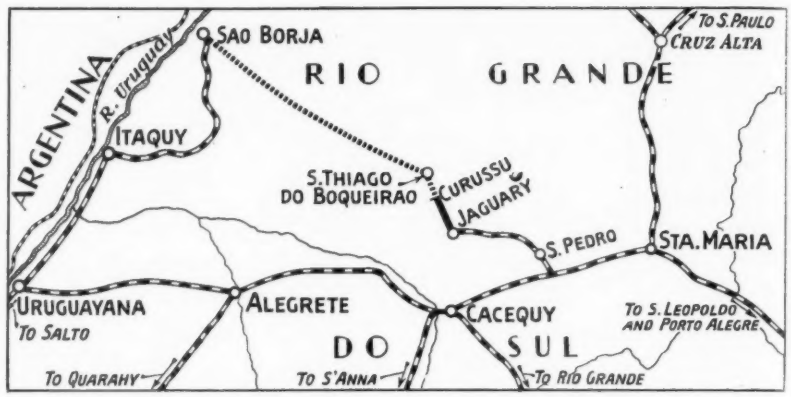
BRAZIL

E.F. Noroéste do Brasil

In connection with the improvements scheme which is being financed by the Paulista Railway Company and the São Paulo State Government, an engineer of the above railway, Snr. Fernando de Freitas, left for Europe recently in order to supervise the construction of 18 locomotives, which are being built by the German firms of Borsig and Henschel.

Viação Ferrea do Rio Grande do Sul

The first link—between Jaguary and Curussú—in the new chord line from Jaguary to São Borja, was opened for traffic on June 11. This new route is of considerable importance in that it gives direct access to São Borja, the terminus of the Uruguayana—Itaquy-São Borja line, from Porto Alegre, São Leopoldo, Santa Maria and other towns, thus obviating the necessity of the long detour *via* Cacequy, Alegrete and Uruguayana, see map above. The construction work upon the section now completed, which has been carried out



Sketch map showing new line to São Borja, Brazil, now under construction

by the 1st Railway Battalion, was in mountainous country involving heavy work, and included bridges over the Jaguary and Curussú Rivers. A further 30 km. of line beyond Curussú to Santiago de Boqueirão is expected to be opened by the end of the year and 20 km. or 30 km. of track should also have been laid from the São Borja end of the line by then.

Railway Engineering and Legislation Congress

With the full support of the Government, through the medium of the Ministry of Transport, it is intended to hold a Congress of Brazilian Railway Engineering and Legislation in October to commemorate the centenary of the first law in favour of railway construction, which was sanctioned by the Regent of the Brazilian Empire, Padre Diogo Antonio Feijó, on October 31, 1835. The Engineering Club of Brazil, which organised in Rio the first Congress of Brazilian Railways in 1882 (the year the club was formed), and the subsequent exhibition in 1887, has decided to support the scheme and also make some practical contribution to the commemoration. Conjointly with the actual congress there will be held a railway exhibition, embodying plant, installations and rolling-stock, descriptions of important works and undertakings, organisation of public services, and all matters related directly or indirectly to the railways of the country.

ARGENTINA

Record Argentine Maize Harvest

The forecast published in THE RAILWAY GAZETTE of April 5 that this year's Argentine maize harvest promised to be of record proportions has now been confirmed by the Ministry of Agriculture, which estimates the crop at 11,500,000 tons, giving an exportable surplus estimated at 8,379,316 tons. This year's total is therefore 4,974,040 tons, or 76·2 per cent. higher than that of last year, and exceeds the average for the last 5 years by 3,756,215 tons, equivalent to 48·5 per cent. This year's figure is 840,000 tons higher than that registered in 1930-31, when the production amounted to 10,660,000 tons, the highest then recorded. The annual production during the previous 5 years, together with the average for the period, is shown below:—

Year	Tons
1929-30	7,128,068
1930-31	10,660,000
1931-32	7,603,391
1932-33	6,801,504
1933-34	6,525,960
Average (5 years) ...	7,743,785

SOUTH AFRICA

Johannesburg Railway Improvements

An extensive scheme for the improvement of railway facilities within the City of Johannesburg has been decided upon. This includes the elimination of all level crossings from Malvern on the east to Langlaagte on the west; the distance covered by the proposed improvements is approximately eight miles. The regrading of the line from Braamfontein subway to Langlaagte, the lowering of the section from George Goch to Doornfontein and the construction of one and a quarter miles of new line from Ellis Park halt to near George Goch station are entailed. Among the larger works connected with the scheme are the building of a new station at Jeppe, the construction of three road bridges between Jeppe and Doornfontein and the elimination of the Jeppe subway. The regrading of the Braamfontein-Langlaagte section will involve the building of three new bridges. It is anticipated that the scheme will cost approximately £700,000, of which £450,000 will be borne by the Municipality.

New Works Programme

Of the £4,666,143 total sanction in the New Works Programme for the year ending March 31, 1936, £3,512,318 are allowed for new works on existing lines as against only £113,659 for rolling stock. Construction of new lines is allotted only £90,760.

THE HORSE-POWER OF LOCOMOTIVES—ITS CALCULATION AND MEASUREMENT—IV

By E. L. DIAMOND, M.Sc. (Eng.), A.M.Inst.C.E., A.M.I.Mech.E.

This is the fourth of a series of articles giving a critical account of the work that has been done in various parts of the world on a subject that today has acquired a new importance in view of the competition between the steam locomotive and other methods of railway traction. The previous articles appeared in our issues of April 12, May 3, and June 14.

Genesis of the Russian Experiments.—Borodin's early experiments with a stationary testing plant and his paper before the Institution of Mechanical Engineers* in 1886 have already been mentioned. To Russia also belongs the credit of first carrying out tests under constant conditions on the road; but whereas Borodin's test plant experiments were only tentative, the real beginning of what later became the American method of testing being Professor Goss's experiments at Purdue, Loevy's road tests were the commencement of a consistent development of technique during some forty years. For most of this time little attention was paid to this work in other countries, but eventually the methods evolved were adopted and perfected in Poland and Germany and became the modern European method of testing. A special section will be devoted to a description of this method and its variants at a later stage, but for the sake of historical continuity its genesis in Russia is referred to here. Loevy actually used an auxiliary locomotive to assist in maintaining constant conditions, but generally speaking the principle followed in the Russian experiments was to choose a suitable length of track and to use only the dynamometer car brakes as a controlling force. Loevy's experiments did not attain success, but his work was taken up by Professor Lomonossoff, to whom the chief credit for the evolution of this method of testing belongs, and in 1900 Professor Lomonossoff accomplished the first successful test under constant conditions. In 1905 the method was fully established, and in 1908 the Russian experimental bureau was set up.

The year 1905 may be regarded conveniently as the commencement of a new experimental era in the measurement of locomotive horse-power, for in that year also the first locomotive tests of the Pennsylvania Railroad in co-operation with the American Society of Mechanical Engineers and the American Railway Master Mechanics' Association on the new testing plant at Louisiana Purchase Exposition, St. Louis, were published. Thus two quite distinct and independent lines of development were initiated, which have persisted to the present day. They are distinguished by a fact of considerable importance. Generalised formulæ and tables have been developed from the American results, whereas the Continental experimental workers have so far consistently held that generalised formulæ or data are not reliable and that the best that can be done in drawing up a new design is to use the test results from a locomotive of as nearly similar a design as possible, especially in regard to cylinder and valve gear arrangement.

A probable reason for this difference is that the American data have been largely evolved and used by two very large firms of locomotive builders.† In such matters as cylinder and valve gear design these firms would naturally be dealing with relatively standardised conditions, and generalised formulæ can possibly be applied with a greater degree of confidence to locomotive types designed and constructed by the same builders. At the same time, it is worth noting that a greater variety of valve motions are in common use in America than in Europe.

* *Loc. cit*

† The Baldwin Locomotive Works and the American Locomotive Company

THE AMERICAN METHODS OF TESTING AND HORSE-POWER CALCULATION

The Pennsylvania Testing Plant.—After the St. Louis tests the Pennsylvania Railroad Company's testing plant was permanently established at Altoona, and bulletins giving full details of tests on various modern American locomotive types have since been regularly issued. The

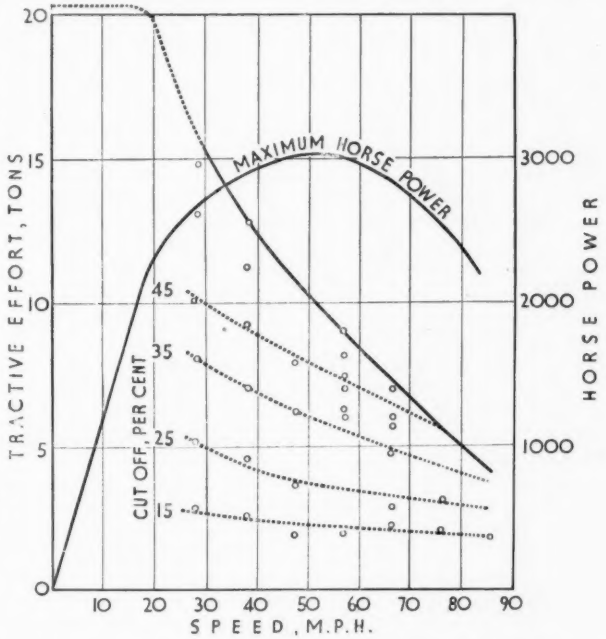


Fig. 7—Tractive effort characteristics (Pennsylvania test plant)

general principle of testing is as follows. The reversing lever is set so as to give the shortest possible cut-off and the regulator is opened wide. A test at low constant speed is then run under these conditions. The cut-off is then advanced by a certain percentage and another test at the same speed is run. Successive advancements of cut-off are made until the limit of adhesion is reached or the boiler is no longer able to supply sufficient steam to maintain pressure. The speed is then increased and a new series of tests is made at increasing cut-off until the whole range of operation of the locomotive is covered.

This method permits of the construction of a series of tractive effort–speed curves* for various cut-offs, together

* These are referred to as drawbar pull-speed curves in the Bulletins of the Pennsylvania Railroad. It must be emphasised, however, that the force actually measured is the tractive force on the axlebox guides, which is only 2–3 per cent. less than that at the driving wheel rims. The use of the term "drawbar pull" in connection with stationary plant tests is to be deprecated as it causes much confusion.

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with a limiting curve at full boiler capacity giving the maximum tractive effort. Fig. 7 gives an example of such a set of curves for the well-known Pennsylvania K4s Pacific type locomotive, having 6 ft. 8 in. driving wheels. A curve of maximum horse-power has been added.

Most of the earlier tests at St. Louis, as a matter of fact, fell somewhat short of this programme as the number of individual tests was limited, and only one or two at the higher speeds were run at the maximum evaporative rate of the boiler. For this reason a process of extrapolation had to be resorted to in order to obtain the curve of maximum tractive pull. Two sets of curves were used, namely, steam consumption per indicated horse-power hour, and indicated horse-power, for the several speeds, both on a basis of cut-off. The maximum evaporative capacity of the boiler having been determined from one high-speed test, it is then only necessary to select for each speed the point at which the product of indicated horse-power and steam consumption, as given by the extrapolated curves, is equal to the maximum rate of evaporation.*

The Baldwin Tractive Effort Curves (1912).—The Baldwin Locomotive Works published in 1912 a set of generalised tractive-effort–speed curves.† These are actually merely an application of Professor Goss's law,

$$\text{i.h.p.} = 0{\cdot}43 \times \text{heating surface (sq. ft.)},$$

slightly modified. If the horse-power of a locomotive is fixed at a certain figure, it is evident that above a certain speed a diminishing proportion of the rated cylinder tractive effort‡ can be realised. This critical speed and the proportion of the rated tractive effort at any high speed will depend only on the ratio of the tractive effort to the heating surface, and the Baldwin curves are therefore drawn for a series of values of this ratio. It is important, however, to realise that although cylinder dimensions enter into the tractive effort values, they do not affect the horse-power which the locomotive is considered to give, so that the Baldwin method is in principle no advance upon the early German formulæ based simply on the heating surface.

The modifications of Professor Goss's law are as follows. In the first place, instead of the indicated horse-power the horse-power at the rim of the driving wheels is used as the basis. It is assumed, following Professor Goss, that an evaporative rate of 12 lb. of water per square foot of water heating surface per hour will represent the boiler power for both saturated and superheated steam. It is further assumed that the engine has a constant consumption at all speeds of 28 lb. of saturated steam or 21 lb. of superheated steam per horse-power hour at the rim of the driving wheels. Thus, for saturated steam the factor $12/28 = 0{\cdot}43$ is the same as was given by Professor Goss, though the horse-powers are measured at different points, whilst for superheated steam the factor is modified to 0·57. At speeds below 30 m.p.h. an allowance is made for a lower maximum rate of evaporation, the upper horizontal portion of the horse-power curve being joined to the straight limb in the adhesion range, by a smooth curve. The resistances of locomotive and tender are given by the formula,

$$R = 4{\cdot}3 + 0{\cdot}0030\ V^2$$

where V is the speed in miles per hour, whence the drawbar horse-power may be calculated.

A probable reason why the Baldwin curves are based on the power at the rail instead of on the indicated power is the difficulty of estimating the internal machine friction of a locomotive. The Pennsylvania tests give much higher losses on this account than Professor Goss's figure of 3·8 lb. per sq. in. constant mean effective pressure—up to four times as much even for four-coupled locomotives. The figures are very erratic, however, and it has not been possible to relate them to any formula. These losses include, of course, the journal, windage, and rail resistances of the driving wheels, which should be excluded from the power at the rim of the driving wheels,* but even so the Baldwin formula tends to give, for modern locomotives with large boilers, rather high values for indicated horse-power if these be obtained by adding suitable values for the machine friction. Indeed, as will appear in a later diagram, the results are comparable with those for indicated or cylinder horse-power obtained by the later American methods.

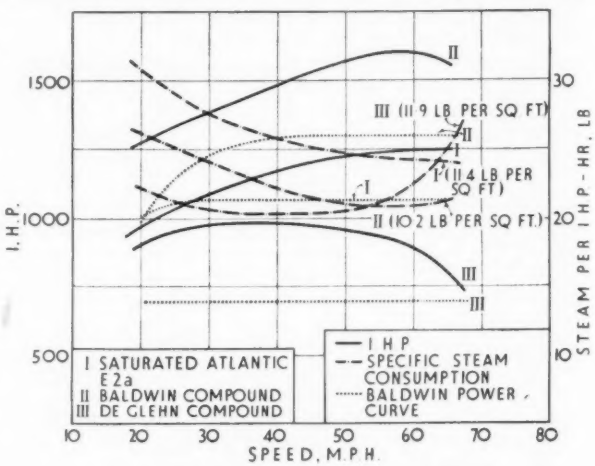

Fig. 8—Specific steam consumption and i.h.p. for three locomotives tested at St. Louis

Fig. 8, which gives curves of specific steam consumption and indicated horse-power for three of the earlier saturated express locomotives tested at St. Louis and Altoona, shows clearly that the assumptions underlying the Baldwin method are far from correct for all locomotives. These curves correspond to the maximum power of the locomotives, as deduced by the method of extrapolation described above. The actual maximum rate of evaporation is given in figures alongside the steam consumption curves, and it will be seen that this varies considerably, and in the case of the compound locomotive built by the Baldwin Works itself, falls considerably short of the standard rate of 12 lb. per sq. ft. of heating surface per hour. Both the steam consumption and indicated horse-power curves represent far from constant values, and they do not follow a uniform law of variation. The horse-power curves given by the Baldwin formula are shown dotted, but it should be explained that, according to the Baldwin handbook, from

* This method of extrapolation is open to the grave objection that the power of locomotives in the lower range of speed is limited more often by cylinder size than by the evaporative capacity of the boiler. This point will be specifically referred to in a later article.

† "Locomotive Data," Baldwin Locomotive Works, Philadelphia, Pa.

‡ The rated tractive effort of a two-cylinder simple locomotive is given by the formula $0{\cdot}85\ Pd^2s/D$, where P is the boiler pressure in pounds per square inch, d is the diameter of the cylinders, and D of the driving wheels, in inches, s is the piston stroke in inches, and 0·85 is a factor to allow for throttling of the steam and machine friction. It is obtained by equating the work done by the steam acting on the pistons and that done by the tractive force at the rim of the driving wheels through one revolution of the driving wheels.

$$\text{Horse-power} = \frac{\text{tractive effort} \times \text{miles per hour}}{375}$$

* See page 1155, June 14 issue

10 to 20 per cent. should be added in the case of compound locomotives.

Cole's Ratios (1914).—F. J. Cole published his so-called "locomotive ratios," as used by the American Locomotive Company, two years later, in 1914.* Cole reverted to the older practice of reckoning in terms of horse-power rather than tractive effort. For the purpose of calculating the power of an existing locomotive his method was the opposite of the Baldwin in that it was based solely on the cylinder tractive effort. The basis is a table of empirical speed factors, derived from a study of test plant results.

Fig. 9 gives the indicated horse-power–speed curves for saturated- and superheated-steam locomotives based on the Cole constants. These curves are based on piston speed, but a scale of miles per hour has been added for a locomotive having 80-in. driving wheels and 26-in. stroke. The corresponding speed factors giving the percentage of the total tractive effort available at each speed are also tabulated in the American Locomotive Company's handbook and the maximum cylinder horse-power must therefore be calculated at the appropriate speed and using the

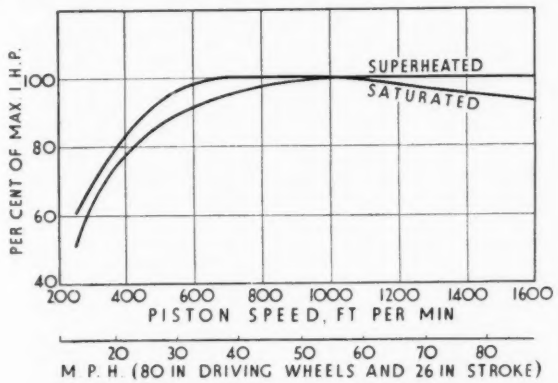

Fig. 9—Horse power curves (Cole's constants)

corresponding speed factor as a multiplier of the rated tractive effort. For example, for superheated steam

$$\text{i.h.p.} = \frac{0{\cdot}85 \text{ P} \times 0{\cdot}445 \times 1{,}000 \times 2\text{A}}{33{,}000}$$

$$= 0{\cdot}0229 \times \text{P} \times \text{A}$$

where P is the boiler pressure in pounds per sq. in. and A is the area of the piston in square inches. The factor 0·85 is the usual proportion of the boiler pressure taken in the rated tractive effort formula, and 1,000 (ft. per min.) is the piston speed at maximum horse-power. The figure 0·445 is the speed factor.

Although the evaporative capacity of the boiler does not enter into the Cole horse-power formula, yet it was the boiler to which Cole devoted most attention in his "locomotive ratios." The aim, however, was to enable the designer of a new locomotive to design a boiler which should be able to supply at all speeds just sufficient steam to develop in a given set of cylinders the horse-power deduced as above. Such a boiler he described as having 100 per cent. capacity. In order to link boiler and cylinder horse-power together in this way standard steam consumption rates of 27 lb. per i.h.p.-hr. for saturated steam and 20·8 lb. per i.h.p.-hr. for superheated steam were assumed. But Cole went much further than specifying an overall rate of evaporation for the boiler heating surface. He apportioned the evaporation in the following way: firebox and combustion chamber, 55 lb. per sq. ft. per hr.; 2-in. tubes, 18 ft. long, $\frac{5}{16}$-in. spaces, 9·54 lb., and $2\frac{1}{4}$-in. tubes, 18 ft. long, $\frac{5}{16}$-in. spaces, 10 lb. per sq. ft. per hr., the latter being base figures on which are calculated and tabulated values for various spacings and lengths. Cole also postulated that the grate area in square feet should be equal to the maximum horse-power divided by 30 in the case of saturated steam or 36·9 in the case of superheated steam.

Cole's ratios can, of course, be used to calculate the evaporative capacity of an existing boiler, and their significance lies in the fact that, unlike all the horse-power formulæ hitherto evolved, they go some way towards taking into account individual factors in design. These factors, as has been indicated, are confined to the boiler. Broadly speaking, and in normal circumstances, the detail design of the engine has a greater effect on locomotive power than the detail design of the boiler, so that in a sense Cole's ratios begin the refinement of horse-power calculation at the wrong end. Unfortunately, however, the factors affecting locomotive performance are so complex and difficult to measure that no simple way has yet been found of taking into account any dimensions of the engine other than cylinder diameter and stroke.* Beyond expressing the result as so much more or less than 100 per cent. capacity, however, Cole established no rules by which the effect of boiler capacity on cylinder horse-power could be determined.

To calculate drawbar horse-power the American Locomotive Company gave the internal machine friction as equal to 25 lb. per ton of weight on the driving wheels for all speeds, track resistance included, the rolling resistance of the engine and tender carrying trucks as the same as for carriage resistance, for which empirical values, based on test data, were tabulated, and the head air resistance as equal to 0·002 V^2A, where V is the speed in miles per hour and A the sectional area, assumed to be 120 sq. ft. It will be noticed that by this method the rolling resistance of the driving wheels is included in the machine friction and excluded from the resistance of the locomotive as a vehicle. This makes it impossible to calculate the horse-power at the rim of the driving wheels, but the results obtained after allowing for machine friction by this method correspond exactly to the dynamometer horse-power obtained on a stationary test plant on which as a rule only the driving wheels rotate.

THE FLIEGENDE KÖLNER.—Details are to hand of the regular schedule now being maintained between Berlin and Cologne by the new Maybach diesel-engined railcar which went in service on July 1 and was illustrated on page 87 of our *Diesel Railway Traction Supplement* of July 12. It leaves Cologne at 7.0 a.m. and arrives at Berlin at 12.20 p.m., and thus forms a direct connection with the 10.40 p.m. train from Ostend. The return service leaves Berlin at 7.11 p.m. and arrives at Cologne at 12.18 a.m., connecting with the 1.2 a.m. train to Ostend. Seats in the Fliegende Kölner, which has only second class accommodation, can be booked at the Southern Railway Agency in Cologne or through the Continental Enquiry Office, Victoria station, S.W.1. Passengers travelling from London (Victoria) by the 2.0 p.m. service via Calais can also connect with the Cologne-Berlin railcar service by changing at Brussels. In the reverse direction (also by changing at Brussels), passengers from Berlin by the railcar can travel via the Boulogne-Folkestone cross-Channel service and reach London (Victoria) at 5.22 p.m.

* "Locomotive Ratios," F. J. Cole, Bulletin No. 1017, 1914, American Locomotive Company. See also "Locomotive Hand-Book," American Locomotive Company, 1917, p. 54

* Strahl's formula for mean effective pressure will, however, be referred to later

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BRITISH RAILWAY STATISTICS

"The Railway Gazette" monthly table of freight and passenger traffic figures for April, 1935, as compared with the corresponding period in 1934, compiled from the Ministry of Transport Statement No. 185

Description	Great Britain*	Great Western	London & North Eastern	London Midland & Scottish	Southern
PASSENGER TRAIN TRAFFIC—					
Number of passenger journeys (excluding season ticket holders)	100,393,184	7,361,783	14,363,566	24,270,897	17,624,400
Increase (+) or decrease (−)	+ 7,186,319	+ 516,901	+ 1,074,142	+ 2,303,578	+ 1,097,828
Passenger receipts (excluding season ticket holders)	£4,285,460	£586,579	£846,820	£1,360,169	£939,219
Increase (+) or decrease (−)	+ £808,534	+ £130,934	+ £169,302	+ £295,109	+ £178,142
Season ticket receipts	£855,426	£54,069	£150,904	£228,698	£279,958
Increase (+) or decrease (−)	− £65,903	− £8,405	− £13,372	− £16,033	− £12,021
Parcels and miscellaneous traffic receipts (excluding parcels post)	£1,108,939	£205,589	£329,924	£424,264	£127,667
Increase (+) or decrease (−)	+ £64,862	+ £17,379	+ £27,230	+ £23,701	− £665
FREIGHT TRAIN TRAFFIC—					
Freight traffic (tons) (excluding free-hauled)	20,632,036	4,948,366	9,084,762	9,758,985	1,262,055
Increase (+) or decrease (−)	+ 172,558	+ 117,020	− 301,041	+ 177,373	+ 21,003
Net ton-miles (excluding free-hauled)	1,156,006,663	213,770,440	383,990,792	473,312,825	52,114,996
Increase (+) or decrease (−)	+ 8,839,538	+ 4,957,321	− 5,370,761	+ 6,451,033	+ 2,235,044
Average length of haul (miles) (excluding free-hauled)	56·03	43·20	42·27	48·50	41·29
Increase (+) or decrease (−)	− 0·04	− 0·02	+ 0·79	− 0·22	+ 1·10
Freight traffic receipts	£6,569,963	£1,129,000	£2,070,700	£2,791,000	£369,836
Increase (+) or decrease (−)	+ £170,304	+ £47,000	− £25,300	+ £134,000	+ £11,630
Receipts per ton-mile	1·364d.	1·27d.	1·29d.	1·42d.	1·70d.
Increase (+) or decrease (−)	+ 0·025d.	+ 0·02d.	—	+ 0·05d.	− 0·02d.
Freight train-loads—					
Average train-load (tons)	125·25	130·74	130·09	123·10	104·58
Increase (+) or decrease (−)	− 2·40	− 0·92	− 4·99	− 1·95	+ 3·04
Net ton-miles—					
Per train engine-hour	1,022·63	1,087·84	1,061·99	997·92	836·43
Increase (+) or decrease (−)	+ 2·93	+ 9·90	− 9·29	+ 7·22	+ 30·59
Per shunting-hour	860·64	787·54	931·16	900·29	572·99
Per total engine-hour	467·33	456·82	496·14	473·30	340·04
Net ton-miles per route-mile per working day	2,654	2,626	2,798	3,138	1,167
Increase (+) or decrease (−)	− 87	− 50	− 157	− 85	+ 21
Wagon-miles. Total	340,646,609	62,184,604	116,634,626	142,714,559	17,108,392
Increase (+) or decrease (−)	+ 6,017,917	+ 1,223,519	+ 1,137,314	+ 3,307,817	+ 426,406
Percentage of loaded to total	66·90	68·01	64·53	68·53	65·75
Wagons per train—					
Total	34·62	35·13	35·12	34·48	32·01
Increase (+) or decrease (−)	− 0·44	− 0·40	− 0·62	− 0·38	− 0·19
Loaded	23·16	23·89	22·66	23·63	21·05
Empty	11·46	11·24	12·46	10·85	10·96
Train-miles. Coaching—					
Per train-hour	15·21	14·05	14·36	14·62	17·72
Per engine-hour	12·15	11·19	11·15	11·11	14·54
Train-miles. Freight—					
Per train-hour	9·60	10·08	9·56	9·44	9·86
Per engine-hour	3·73	3·51	3·86	3·84	3·20
Engine miles. Total	43,892,801	6,926,148	12,035,415	16,250,602	5,834,103
Increase (+) or decrease (−)	+ 621,780	+ 146,769	+ 161,015	+ 237,640	+ 16,329
Mileage run by engines. Total train-miles—					
Coaching	21,871,498	2,968,595	4,981,395	7,038,535	4,254,361
Freight	9,839,455	1,770,081	3,321,454	4,139,124	534,516
Engine-hours in traffic. Total	4,636,757	793,841	1,377,500	1,794,407	478,282
Increase (+) or decrease (−)	+ 35,187	+ 13,274	+ 5,215	+ 14,735	− 274
Shunting miles per 100 train-miles—					
Coaching	7·52	6·93	6·61	8·25	8·27
Freight	72·71	82·94	68·72	67·77	96·13

* All standard-gauge railways

Passenger Traffic Statistics: Number of journeys, receipts, and receipts per journey (excluding season ticket holders)—April, 1935

Subject	Great Britain	Great Western	London & North Eastern	London Midland & Scottish	Southern	Cheshire Lines Committee	Liverpool Overhead	London Passenger Transport Board†	Mersey
Full fares—									
Passenger journeys	31,557,876	736,065	1,170,478	1,742,744	2,783,100	20,340	146,698	24,085,325	87,426
Gross receipts	£894,160	£84,254	£124,488	£136,403	£196,421	£2,717	£1,526	£331,310	£1,638
Receipts per passenger journey	6·80d.	27·47d.	25·53d.	18·78d.	16·94d.	32·06d.	2·50d.	3·30d.	4·50d.
Reduced fares—									
Excursion and week-end—									
Passenger journeys	40,887,176	4,501,350	9,050,833	14,913,315	8,895,428	422,562	101,136	1,298,720	619,728
Gross receipts	£2,696,887	£424,101	£594,298	£1,008,549	£565,834	£27,144	£1,040	£29,252	£9,636
Receipts per passenger journey	15·83d.	22·61d.	15·76d.	16·23d.	15·27d.	15·42d.	2·47d.	5·41d.	3·73d.
Workmen—									
Passenger journeys	23,991,156	1,655,850	3,151,098	6,465,374	5,150,086	223,876	192,798	6,144,844	185,834
Gross receipts	£348,242	£24,379	£51,128	£103,351	£84,558	£3,845	£1,558	£67,850	£1,716
Receipts per passenger journey	3·48d.	3·53d.	3·89d.	3·84d.	3·94d.	4·12d.	1·94d.	2·65d.	2·22d.
Other descriptions—									
Passenger journeys	3,950,552	468,148	989,797	1,145,924	794,694	53,070	41,402	371,533	11,734
Gross receipts	£338,301	£53,418	£74,852	£107,642	£91,319	£3,556	£269	£3,307	£162
Receipts per passenger journey	20·55d.	27·39d.	18·15d.	22·54d.	27·58d.	16·08d.	1·56d.	2·14d.	3·31d.
Total—									
Passenger journeys	100,393,184	7,361,783	14,363,566	24,270,897	17,624,400	719,880	482,034	31,900,422	904,722
Gross receipts	£4,285,460	£586,579	£846,820	£1,360,169	£939,219	£37,301	£4,393	£43,719	£13,152
Receipts per passenger journey	10·24d.	19·12d.	14·15d.	13·45d.	12·79d.	12·44d.	2·19d.	3·25d.	3·49d.

† Includes passengers originating on the railway undertakings, and on the Whitechapel and Bow Joint Railway

THE TRANSPORT OF FOOD BY RAIL*

I—A survey of the volume of traffic carried by home and overseas railways in ensuring an adequate supply of cheap food to industrial populations

By Sir HAROLD HARTLEY, C.B.E., M.C., F.R.S.,
Vice-President, London Midland & Scottish Railway

IN dealing with the transport of food on land, I want first to sketch very briefly the part played by rail transport in meeting the new and complex tasks which confronted the food industry of Great Britain in the nineteenth century. The steam engine was applied first to driving the machines which were the basis of the Industrial Revolution, and then its application to transport made possible the rapid flow of raw materials and commodities culminating in the world trade which was the predominant feature of the last century. The railways, by quickening the industrialisation of Great Britain, helped to create the problem of the food supply to great cities, but they also provided its solution, for like every other industry the food industry owes largely to transport its present complex organisation in this country.

Even before the railway age the feeding of the growing population of the cities was becoming a problem. Loudon in 1831 wrote in his Encyclopædia of Agriculture: "Already country dairies have sprung up at the distance of from five to twenty miles from London, and the milk and cream are sent to town in close vessels in spring carts, which go at a rapid trot. When instead of these spring carts, railroads are established, on which carriages may go at the rate of thirty miles an hour, the milk and butter used by the commonest people of London will be of as good a quality as that now used almost exclusively by gentlemen who have country seats."

Loudon foresaw clearly the part the railways were to play in improving the diet of the people by making good food equally available to all classes, but his prophecy was not realised so quickly as he had anticipated, as the promoters of the early railways did not attach much importance to the conveyance of foodstuffs, which were rarely mentioned in the sections of the early Acts of Parliament dealing with the authorised charges for different commodities. However, with the growth of industrialism, fostered by the railways, the population became concentrated more and more in great urban areas, and the people both required and could afford a higher standard of living, which found its expression in a better and more varied diet, and this the railways were called on to transport. For instance, in 1842 it was still the custom to move cattle across England from Devon, Hereford, Yorkshire and Scotland in the old leisurely drover's fashion to the East Coast, where they were fattened and subsequently driven by road to London. By 1870 this practice had been rendered obsolete by the railways, and the speeding up of transits enabled the area of supply to be greatly extended, while the waste due to the deterioration of livestock through long road journeys was eliminated.

The supply of milk, that invaluable but most perishable of foods, was another example of the value of rail transport. The passage I have quoted from Loudon shows that in 1831 horse transport was beginning to replace the practice of driving cows from house to house and milking them before the doors as a guarantee of purity. At first there were difficulties, but gradually these were overcome, the necessary organisation was built up, and the area of supply was widened so that by 1870 milk was passing to London, thanks to rapid rail transit, from distances up to 150 miles.

During the eighteenth century, Britain exported about as much foodstuffs as she imported, exporting wheat and provisions and importing oats and sugar, but the rapid growth of population and the higher standard of living in the nineteenth century soon made it clear that the home production of food was unequal to the nation's needs. Here again, railway development helped to provide adequate supplies of cheap food. Until 1846 it had been the policy of the Government to maintain the price of home grown wheat, and the abolition of protective duties by the Repeal of the Corn Laws in that year may have prevented any rise in the price, but it was not until railway development in the United States opened up the great wheat growing areas of the Middle West that large supplies of wheat began to pass across the Atlantic, and that the price in England fell from 56s. 9d. a quarter in 1877 to 22s. 10d. in 1894. The following table shows the rapid growth in the volume of wheat imports from Canada, U.S.A. and Australia between 1840 and the close of the century:—

WHEAT IMPORTS INTO GREAT BRITAIN

	U.S.A.	Canada	Australia
	Cwt.	Cwt.	Cwt.
1840	258,321	28,672	Nil
1870	12,371,922	2,838,361	85,222
1900	32,588,470	6,337,600	2,651,600

After the completion of the Canadian Pacific Railway between Winnipeg and the head of Lake Superior, wheat began to move regularly to Eastern Canada and thence to British ports. Canada, thereafter, took the lead as the principal supplier of wheat to Great Britain, and today 36 per cent. of our imports come from the Canadian West.

Railway developments overseas opened up many new sources of food supply, and in 1880 the introduction of refrigerating machinery enabled this country to obtain increased meat supplies from abroad to feed its growing population. The following table shows the growth in imports from Canada, U.S.A. and Australia, between 1854 and 1900:—

MEAT IMPORTS INTO GREAT BRITAIN

	U.S.A.	Canada	Australia
	Cwt.	Cwt.	Cwt.
1854	609,420	6,985	Nil
1870	605,284	21,610	73,984
1900	9,541,542	822,987	1,308,834

The latest phase in the development of the transport of food is the result of the pioneer study of the causes of the deterioration of foodstuffs and its prevention by the late Sir William Hardy and his co-workers at Cambridge, Aberdeen and Ditton, and the extension of their work in other countries, for instance in South Africa, in relation to their

* A paper presented to the Society of Chemical Industry annual meeting at Glasgow on July 3

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special problems. This has extended enormously the possibilities of storing and of transporting perishable foodstuffs, so that today the diet of all classes is much more varied and is rapidly becoming independent of season.

The following table gives the volume and sources of the five principal groups of foodstuffs in 1933:—

SOURCES OF FOOD SUPPLIES OF GREAT BRITAIN (1933)

Class of foodstuff	Volume (million tons)				
	Imports:			Home production	Total
	Empire	Foreign	Total		
Cereals	4·34	5·41	9·75	3·52	13·27
Sugar, &c. ..	0·78	1·26	2·04	0·39	2·43
Meat	0·37	1·26	1·63	0·92	2·55
Fish	—	—	0·18	0·68	0·86
Dairy produce ..	0·4	0·22	0·62	4·78	5·40
Vegetables and fruit	0·74	1·26	2·00	6·22	8·22
					32·73

The total quantity of foodstuffs approaches, therefore, 33 million tons annually, of which approximately 17 million tons are sea-borne. Complete information is not available as to the foodstuffs conveyed by British railways, but the figures below give some indication of the present volume of the traffic, while the complete statistics for 1929 show that in that year foodstuffs represented 7 per cent. of the total traffic:—

FOODSTUFFS CONVEYED OVER BRITISH RAILWAYS IN 1934
BY GOODS TRAIN SERVICE

Grain and flour (2 tons and upwards) ..	3,874,500 tons
Sugar, glucose, &c. (2 tons and upwards) ..	810,700 ,,
Vegetables (2 tons and upwards)	2,902,100 ,,
Livestock (excluding horses)	10,397,000 head

BY PASSENGER TRAIN SERVICE

Milk	181,067,000 gallons
Fish	405,200 tons

The corresponding figures for some of the Dominion and Colonial railways, summarised at the top of the next column, and given in detail in the table below, make an interesting comparison, as with them the conveyance of food represents a much more important part of their revenue, and much of this traffic is carried to the coast for transport overseas.

Railway transport, besides carrying home-grown food, is an essential complement to sea transport for carrying food to the ships and for distributing it on arrival. The railway problem is usually simpler owing to the shorter times of transit, and the bulk of rail-borne food is conveyed without special precautions. In many cases the expense of conditioned transport is avoided even with perishable food by quick service, including collection and delivery, but there is a growing demand for refrigerated transport especially since the limitation of the use of preservatives in this country by the Public Health Regulations of 1927.

VOLUME OF FOODSTUFFS CARRIED ON EMPIRE RAILWAYS

	Tonnage of foodstuffs conveyed	Percentage of total freight traffic
Canada		
Canadian Pacific Railway ..	7,770,192	35·3
Canadian National Railways ..	8,334,712	26·6
South Africa		
South African Railways ..	4,973,815	27·7
East Africa		
Kenya & Uganda Railways ..	230,740	30·1
Australia		
Victorian Railways	1,357,303	21·9
South Australian Railways ..	1,016,322	47·6
New South Wales Railways ..	2,733,064	25·0
Western Australian Railways ..	1,257,212	44·1
New Zealand		
New Zealand Railways	780,788	14·2

Deterioriation of Food in Transit

The causes of the deterioration of perishable food in transit may be grouped roughly under three headings:—

(1) Chemical changes due mainly to the action of enzymes normally present in the food.

(2) Changes due to micro-organisms with which the food becomes contaminated from external sources.

(3) Changes in appearance which affect the saleability of the food, such as the loss of bloom of meat.

Changes of the last kind are specific to each class of foodstuff and may need special precautions in each case; humidity is often an important factor, for example, either excess of moisture or excessive dryness of the air will destroy the bloom on meat.

Since both the rate of chemical change and the rate of growth of micro-organisms fall rapidly with temperature, it is possible to protect food in transit from deterioration due to the first two causes by keeping it at a temperature at which chemical and bacterial changes are negligible during the journey, and by protecting it as far as possible from contamination in suitable wagons or containers. The problem of refrigerated transport on land is entirely different from that on sea as it involves the conveyance of foodstuffs in wagons or containers for relatively short periods, rarely exceeding two days, at the required temperature. Obviously, the most important point in the construction of the vehicle is the insulation which prevents leakage of heat through the walls, so that if the contents are pre-cooled before starting there is only a small temperature rise during transit, or if refrigerants must be used, the amount and therefore the cost is made as small as possible.

(*To be continued*)

VOLUME OF FOODSTUFFS CARRIED ON EMPIRE RAILWAYS

	Canada		South Africa		East Africa		Australia								New Zealand	
	Canadian National Railways		South African Railways		Kenya & Uganda Railways		Victorian Government Railways		South Australian Government Railways		New South Wales Government Railways		Western Australian Government Railways		New Zealand Government Railways	
	Tonnage	Total	Tonnage	Total	Tonnage	Total	Tonnage	Total	Tonnage	Total	Tonnage	Total	Tonnage	Total	Tonnage	Total
		%		%		%		%		%		%		%		%
Grain	5,277,596	16·8	1,451,146	8·1	90,862	11·9	1,104,127	17·7	848,683	40·2	2,368,743	21·7	1,041,011	36·6	269,367	4·9
Other cereals ..	1,496,581	4·8	694,805	3·9	41,768	5·5	—	—	65,555	2·9	—	—	146,126	5·1	—	—
Vegetables ..	302,644	1·0	219,150	1·2	8,002	1·0	—	—	20,285	0·9	—	—	—	—	—	—
Fruit	294,491	0·9	285,858	1·6	—	—	148,873	2·4	52,720	2·3	154,855	1·4	70,075	2·4	44,372	0·8
Dairy produce ..	131,412	0·4	47,717	0·3	—	—	93,129	1·5	—	—	—	—	—	—	241,703	4·4
Meat	354,846	1·1	5,612	0·02	—	—	—	—	—	—	122,234	1·1	—	—	217,538	4·0
Fish	56,627	0·2	11,580	0·06	—	—	4,581	0·1	—	—	—	—	—	—	7,808	0·1
Liquors	80,739	0·3	96,834	0·5	2,231	0·3	6,593	0·2	26,564	1·2	—	—	—	—	—	—
Other provisions ..	339,776	1·1	2,161,113	12·0	87,877	11·4	—	—	2,415	0·1	87,232	0·8	—	—	—	—
Total ..	8,334,712	26·6	4,973,815	27·7	230,740	30·1	1,357,303	21·9	1,016,222	47·6	2,733,064	25·0	1,257,212	44·1	780,788	14·2

THE TRANS-IRANIAN SECTION, IRANIAN (PERSIAN) STATE RAILWAYS

A description of the first trunk line in Iran, its constructional difficulties and other features

THE long seclusion of Iran, or Persia as it is still better known, and its absence from the map of world trade routes has been due to its peculiar geographical, or rather topographical situation. For though it consists mainly of a great plateau with several open fertile valleys running from east to west, it is hedged about with natural obstacles making ingress from without most difficult. To reach the plateau from north or south, the only directions of approach from a seaboard, the formidable Elburz or the even more fearsome Luristan mountains, have to be crossed, with the result that railways or roads to carry heavy traffic can be constructed only at almost prohibitive cost.

However, even in Iran times are now changing rapidly, and in so far as transport is concerned these changes have been greatly accelerated by the accession of that enlightened ruler, His Imperial Majesty, Riza Shah-Pahlevi. He has lost no time before insisting upon the earliest possible construction of a system of trunk roads, and on the completion of preliminary work required for a Trans-Iranian Railway, which will cut right across Iran from the Caspian Sea to the Persian Gulf and so, at one stroke, will not only bring foreign trade into the heart of the country, but will also provide a through route from Central to South Asia.

Not that this is the only railway contemplated, for it is intended that as soon as the northern section of the north-south line is completed, work shall be started upon a westward line from Teheran to Tabriz, there to link up with the Turkish railway system, and connections with both Iraq and India are also proposed. By establishing this main-line star formation, His Imperial Majesty hopes to restore Iran to its important position of long ago as the highway between East and West as well as between North and South, an aim so essential if Iran is once more to become an important unit in the great nations of the world.

Trans-Iranian Construction

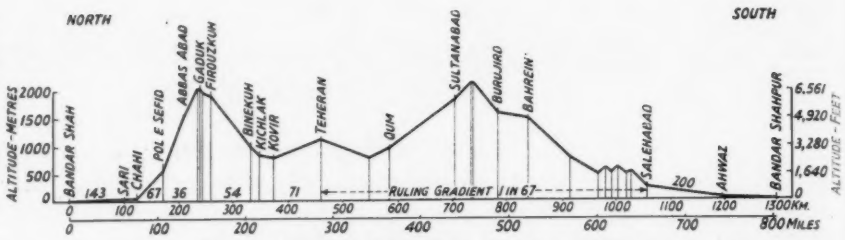
The construction of the southern section of the Trans-Iranian line was first entrusted to an American syndicate and that of the northern section to a German firm, Teheran, the capital, being the point of demarcation between the two sections. But some four years ago, the Iranian Railway Ministry took over both sections, with the intention of completing them under the guidance of Swedish and American experts. These experts, however, could not agree as to the most suitable ruling gradient, the Swedes urging the use of 1 in 30 and the Americans deeming it unadvisable to have grades steeper than 1 in 43½. His Majesty finally settled the point by deciding upon a mean of the two, or approximately 1 in 36. Furthermore, a Danish syndicate, the Kampsax Consortium, was appointed to replace the Swedes and Americans, and at present controls the entire construction work on behalf and under the supervision of the Railway Ministry.

Though it is consulted and has the final decision in the methods used for constructing the larger bridges and tunnels, Kampsax leaves the various firms a free hand in the manner and methods used for all ordinary works on their respective lengths. On the northern section, for instance, almost all known systems of tunnelling have been used. On the southern section, however, where no timber is available and has to be imported or brought from long distances, it is stipulated that the Belgian system must be used.

The gauge adopted is 4 ft. 8½ in. and the line is single throughout. All permanent way so far laid on both northern and southern sections is upon wooden sleepers. The northern section runs through well-wooded country which supplies the necessary timber. This is hewn to size in the forests and taken to Chirja where there is a treating plant. For further lengths of line not yet laid, steel sleepers are to be used as well as wooden, and in

Sketch map of the Trans-Iranian Railway, showing its relation to adjacent systems

February the Iranian Government placed an order valued at 20,000,000 Rials (about £270,000) with the Continental Steel Cartel for the former. As will be seen from the gradient profile reproduced, there are besides the 1 in 36 climb in the north, long lengths of line with 1 in 67, 1 in 71 and 1 in 54 ruling grades, the coastal approaches being comparatively easily graded. There are two main summits, the greatest continuous rise being, however, that from Chirja, or Chahi, at the foot of the Elburz Mountains to Gaduk, where also is the steepest grade.



Gradient profile of the Trans-Iranian Railway

The Northern Section

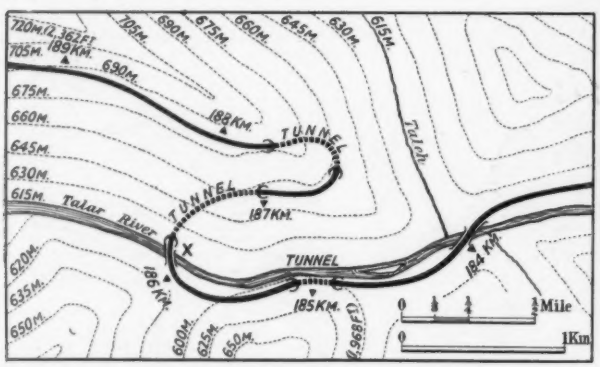
The northern section of the line is considerably the shorter and will connect Teheran with the twin and adjoining ports, Bandar-Ghaez and Bandar-Shah, on the Caspian Sea. From these ports the line runs through fairly level country—the most fruitful part of Iran—in the province of Mazanderan to the foot of the Elburz range. Rice is here the staple crop, but excellent results have also been obtained from experimental plantations of tea, tobacco, American cotton and other products. Southern Iran requires these products, but hitherto there has been no economical means of transport from Mazanderan to supply its needs and the products of this rich province have been sold to the Russians, who have been able to dictate prices and use this trade as a political weapon. The new railway will change all this.

The Savad-Kuh Incline

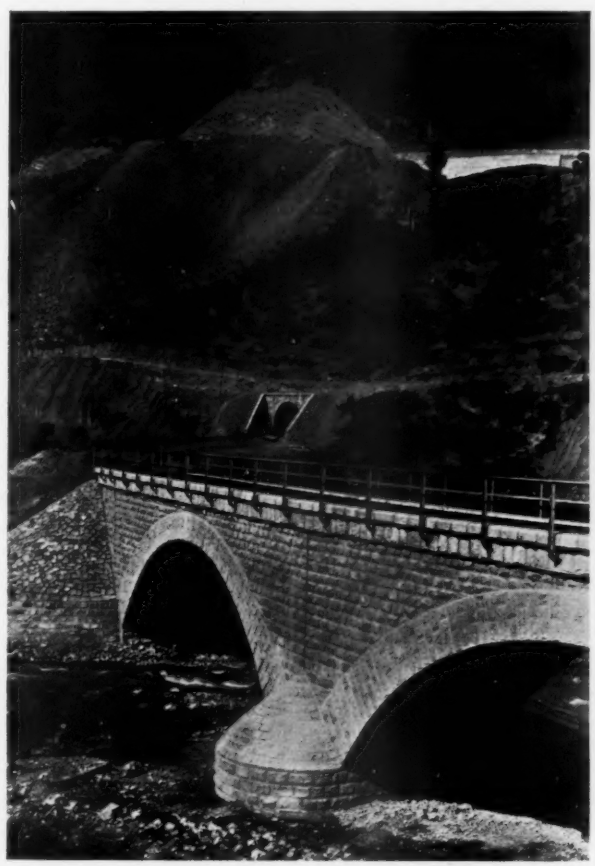
Beyond Chirja, the present terminal of public traffic, the construction engineers had to face the Savad-Kuh or northern slopes of the Elburz mountains, and a climb of nearly 7,000 ft. is necessary to surmount the watershed at its most suitable pass. This northern escarpment of the Elburz is very abrupt and the average gradient is far too steep for any railway, so that the only means of scaling these heights is by developing considerable length, by resorting to spirally curved zig-zags. In several places there are three parallel sections of line on the same hillside, one above the other, and many of the spirals are in tunnel up to a mile in length. So that in spite of the free use of 200-m. (656-ft.) radius curves this line has been very costly. Our sketch plan and illustrations give a fair idea of the alignment and the country traversed.

But what, perhaps more than anything else, has sent up the cost of this enterprising construction work, and caused greatest trouble to the engineers, is the rottenness of the hillsides. This will be appreciated if the illustrations are carefully scrutinised. Very heavy retaining walls had to be constructed over long lengths of line, and in some cases where the whole hillside is constantly on the move, tunnelling and retaining wall combined have had to be used. In one place it was necessary to construct a concrete tunnel heavily reinforced with rails, to keep the constantly slipping hill slope from obliterating the formation. Moreover, not only had it to be very strongly built, but so steep was the side slope that this tunnel had to be founded upon a retaining wall 80-ft. high. This country is also subject to severe earthquake shocks which tend to make the sidelong ground even less stable than it otherwise would be. Heavy rainfall, too, calls for elaborate drainage and the protection of embankments with hand-packed stone pitching and revetments.

As good quality sandstone is available, whereas cement



Sketch plan showing spiral development of length on 1 in 36 Savad-Kuh incline



Arched bridge at X on sketch plan (alongside), with portal of spiral tunnel, and, above, a further section of the line near km. 188 beyond the two spirals

Gaduk Pass, pierced by a tunnel nearly two miles long at the summit of the 1 *in* 36 *Savad-Kuh incline by which the line climbs nearly* 7,000 *ft. from the level of the Caspian Sea to surmount this lip of the Iranian plateau*

Typical heavy hill-side work on the 1 *in* 36 *climb, showing viaduct and retaining wall alternating owing to the side slope being too steep for embankment*

Near the foot of the 1 *in* 36 *incline. Note line to right below and to left above spirals*

An example of the rottenness of the hill-sides, met by resort to heavy and continuous retaining walls over long lengths of line

NORTHERN SECTION, TRANS-IRANIAN RAILWAY

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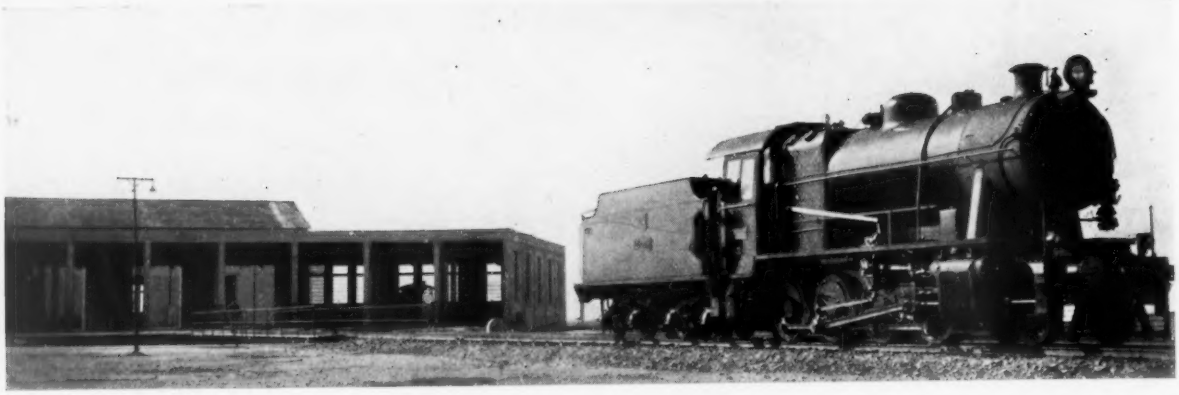

Newly completed ferro-concrete round house with turntable at Ahwaz and first Beyer-Peacock 2-8-0 erected there

Modern station building at Ahwaz. It is replete with circulating hall, comfortable waiting rooms, and convenient offices

Train at station km. 288, some 38 km. north of Salehabad, on the completion of the section from Bandar Shahpur. It happens to be of all-British construction, the engine being one of the Beyer-Peacock 2-8-0's and the train composed of Metropolitan-Cammell covered goods wagons

SOUTHERN SECTION, TRANS-IRANIAN RAILWAY

has, until now, been both costly and varying in quality, most of the bridgework and walling has been constructed in masonry and not in mass concrete. The masonry is of good quality, as may be seen from the illustration of the arched bridge on page 146. This, incidentally, is the bridge at X on the plan on that page, and beyond it in the illustration may be seen the mouth of the long spiral tunnel in which the line doubles back upon itself as it ascends. As the plan shows, it then spirals again—partly in tunnel—and emerges far up on the hillside, as seen in the photographic illustration, running in the same direction as the section of line in the foreground on the bridge.

Reverting to the subject of materials, it is noteworthy that Kampsax has equipped an up-to-date laboratory for testing all kinds of building materials. The country is rich in various mineral salts, which if not combated suitably, play havoc with construction works in quite a short time; hence the importance of the laboratory tests.

The Summit Tunnel

The watershed or lip of the High Iranian Plateau is reached at Gaduk where the 8,000-ft.-altitude pass is pierced by a tunnel nearly two miles in length, and there the most difficult portion of the northern section is left behind. The southern Elburz slopes lead less abruptly down to the inner Iranian plateau. The railway follows the Havlahrud valley, noteworthy for its wealth of common salt, and thence in a tunnel under one of the salt mountains into the desert beyond. At Veramin, where is situated the Czech Skoda sugar factory, the line bends sharply to the right towards Teheran.

The Southern Section

As recently indicated in our Overseas columns, the southern terminal port of Bandar Shahpur has yet to be completed, and tenders for a good deal of construction work connected with it will shortly be invited. Near Ahwaz, the line crosses the Karun, the only navigable river in Iran, by means of a bridge about 1 km. in length. It then has to face the Khuzistan and Luristan mountains, where the most difficult work of all is entailed—considerably more difficult than that already described as obtaining on the northern section. In these two mountain ranges the topography resembles the great canyons of Arizona in the U.S.A. In the basalt granite and porphyry rock masses there are narrow gorges or clefts, some 300 or more feet deep with perpendicular cliffs or sides, sometimes only 30 ft. apart. Through these rush turbulent rivers, in some cases 60 ft. deep. The difficulties of this length of line have already been alluded to in our leader published on July 5 last.

Near Bahrein, however, the alignment at last reaches easier country in which only occasional mountain ranges have to be crossed. Beyond Sultanabad the western branch of the great salt stony plain or desert, the Dasht-i-Kavir, is encountered, and then Qum, a holy place and pilgrimage centre, 130 km. south of Teheran, is passed. This final section to the capital is quite easy. The station at Teheran, which was begun early this year, will be an imposing structure with an up-to-date layout that will be worthy of the largest and capital city of Iran. The station will be the centre of a new quarter of the city. Near at hand also are cement works, completed about a year ago, and other industrial undertakings.

From this brief description and from our illustrations it will be obvious that the civil engineers working for the Iranian Government are engaged upon an undertaking of very great difficulty and extent, for the line is over 800 miles in length. From the operating and mechanical points of view also, a thoroughly efficient job is being made of it. New locomotives and rolling stock of modern design have recently been purchased. These comprise five 2-8-0 type ordered from Beyer, Peacock & Co. Ltd., illustrated and described in THE RAILWAY GAZETTE of October 5, 1934. Put into service at the beginning of this year, they have given complete satisfaction and loads up to 400 tons on long lengths of 1 in 67 grade have been hauled. Two are working on the northern and three on the southern section; some of the latter appear in our illustrations. A second locomotive order has recently been placed with Nydquist and Hölm, of Tröllhatten, Sweden, for twelve 2-8-2 type, and these are now under construction.

Articulated Locomotives for Steepest Grades

The working of traffic over the 1 in 36 section up the northern face of the Elburz mountains presents a special problem, particularly in view of the limited axleload of 15 tons and the tortuous nature of the line. The far-sightedness of the Iranian Government has again been demonstrated in the decision to operate this section with four Beyer-Garratt locomotives of great power, manufactured by Beyer, Peacock and Company. These locomotives will be of the 4-8-2+2-8-4 type and will have a tractive effort at 85 per cent. of 60,000 lb; each will weigh over 200 tons.

As well as the train service between Bandar Shah and Chirja in the north, there is a passenger train three times a week as far as Salehabad in the south and already the line is laid 70 km. beyond this point, or just about 200 miles from Bandar Shahpur.

Rolling Stock

With regard to rolling stock, that supplied for the southern section is largely British built. For instance, the Metropolitan-Cammell Carriage, Wagon and Finance Co. Ltd. supplied, at various times, four-wheel stock of the following types: 12-ton flat rail trucks and tank wagons; another type of rail truck and flat truck; ballast and covered wagons; and finally 60 more covered wagons in 1933-34, some fitted with cabooses and some without. A number of these may be seen in one of our illustrations, which shows a train consisting of one of the Beyer-Peacock engines and Metropolitan-Cammell covered goods wagons. The coaching stock on the southern, and all rolling stock on the northern section is believed to be of Continental origin.

A considerable quantity of bridgework material for the southern section has been supplied by the Patent Shaft and Axletree Co. Ltd., a subsidiary of the Metropolitan-Cammell concern; that for the northern section is understood to be German.

Social and Political Value of Railway

The main interest of the Trans-Iranian Railway lies in its political and social value. The rails will connect the north and south of the country, a connection which is not only desirable but essential for the Iranians. Even the construction work brings about an exchange between the people living in the north with those of the south, from whom they were hitherto more or less cut off. Northern Iranians were formerly separated by caravan journeys which took months, and more recently by motor-car which still requires several days, from their compatriots by the Gulf. It is hardly necessary to dwell on the results which will accrue to the Iranian Empire from the breaking down by the railway of the great mountain and desert barriers. The railway will be the best school for that modernisation of Persia and its linking-up with the West, which is so much desired by the leading Iranians, and it will certainly prove to have been one of the greatest feats of the present ruler.

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THE FIRST PUBLIC RAILWAY IN GERMANY

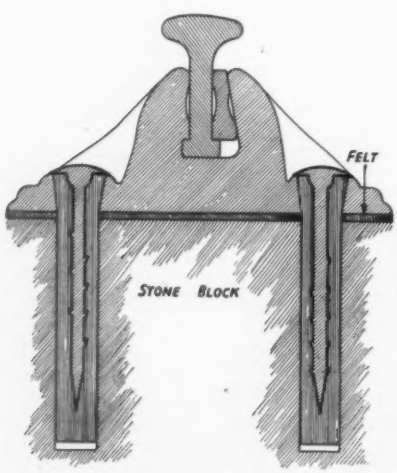
The Nuremberg-Fürth Railway was opened on December 7, 1835, and its centenary is now being celebrated

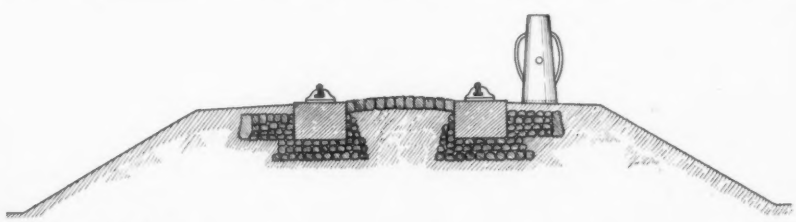
AT the time when the Stockton and Darlington Railway was opened and the new system of steam railway locomotion was taking practical shape in Great Britain, the political condition of the territory now known as Germany was far from favourable to the development of improved means of communication, for there were some thiry-six "states" in existence, each with their own customs barriers and jealous of their rights and privileges. Nevertheless, Goethe, in 1828, remarked that he was not unduly concerned at this want of unity, for "our good highways combined with the newcomer, the railway, will bring about the unification of our country in time."

It may appear strange that the first German railway should have been constructed between Nuremberg and Fürth, but the former was a very important city in the Middle Ages and highly prosperous. It lost something of its commanding position with its incorporation into Bavaria in the Napoleonic era, but was still the centre of several flourishing industries. Nuremberg and Fürth between them counted 54,000 inhabitants in the first quarter of the 19th century and in 1814 a horse tramway to connect them was proposed, as well as a canal. King Ludwig I interested himself in both proposals and approved the canal scheme in 1829, about six months before Stephenson's triumph with the *Rocket* at Rainhill, but was willing to have his name associated with a railway if one should be made.

The original Ludwigsbahn station at Nuremberg

The citizens of Nuremberg were thus thrown on their own resources, no practical help being forthcoming from the authorities, but they were fortunate in having in their midst some determined and influential men who were bent on establishing the new system of locomotion, news of the success of which had reached them from England. The founders of the little line—for it was to be but 3¾ miles long—were Johannes Scharrer, a prominent merchant, twice Mayor of Nuremberg, who was the driving force of the concern; Georg Z. Platner, a wealthy citizen and first manager of the line; Mainberger, an art-dealer; the Mayor of Nuremberg, Binder; the Mayor of Fürth, Bäumen; and three or four prominent citizens, such as Merkel, Schroll, Meyer, and Reissig. By the early part of 1833 they had a prospectus ready. It was couched in prophetic language, emphasising the great benefits to be expected from transport by rail and hinting at a main line through Nuremberg and Fürth from England to the Balkans, the Persian Gulf and the East Indies! Calculations respecting the street traffic between the two towns, based on an actual census taken by observers, indicated that a lively patronage was to be expected. The costs were estimated at 132,000 fl. (fl.=gulden. 1 gulden= 1·714 Reichsmark), or 226,248 RM. The working expenses were put at 12,800 fl. per annum, the income at 29,200 fl. leaving a profit of 16,400 fl. enough to pay 12 per cent. The shares were to be for 100 fl. each.





Above: Section through permanent way of Nuremberg-Fürth Railway. Note ballast tamper on right

Left: Method of supporting the rails

There were, of course, numerous objections to the scheme from all quarters; the Bavarian Medical College, for instance, warned that a species of brain fever would certainly result from travelling at the speeds contemplated! But considerable support was forthcoming all the same, so that by November, 1833, all the money required had been promised among 207 persons. Even the Government then condescended to take up two shares! The preliminary meeting of the company, which took the name of Ludwigs-Eisenbahn-Gesellschaft Nürnberg, was held in that month, with Platner as Manager, Scharrer

as Deputy, and Mainberger as Secretary. Ten per cent. of the promised money was asked for. In December, the project was laid before the King who gave his assent to the undertaking on February 19, 1834, with the condition that the line was to be built within five years.

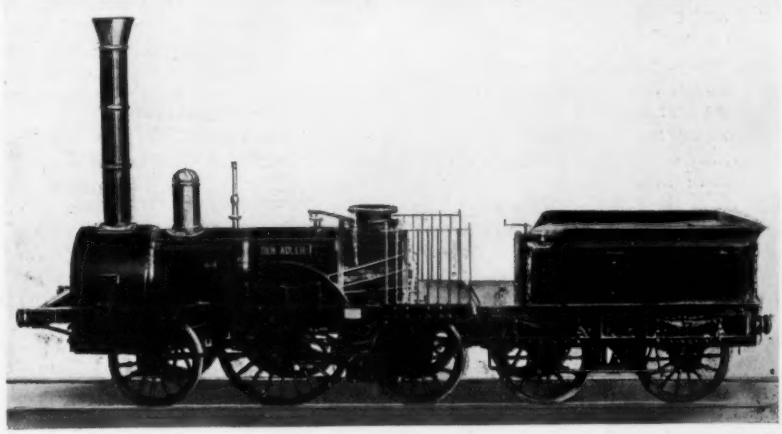
A good survey of the route had been made early in the year by Professor Kuppler of the Nuremberg Polytechnic. The line was to be single, raised on a slight embankment, and 6·04 km. in length, with no curves of any consequence. A great part was level but there was an overall grade of 1 in 1,000 up towards Nuremberg. The conditions were thus very easy for locomotive operation. There was no expropriation law in Bavaria at the time and some landowners made great difficulties and advanced exorbitant demands, in consequence of which a law was passed in 1837. It was only natural that the promoters should look towards England for ideas to guide them as regards the best form of construction to adopt. Friedrich List warned the promoters against the "mistake" of adopting the massive English construction. As regards locomotives it might be well to follow England, but "in that country they would only learn to make a costly track." Notwithstanding this, Scharrer communicated with business friends in London, Messrs. Suse and Sibeth, asking them to get in touch with the Stephensons, and with Braithwaite and Ericsson. He believed that a civil engineer could be found in Germany, but wished for a recommendation if one had to be brought over. Platner also wrote to a friend in Liverpool named Fosbery who knew George Stephenson and subsequently became a shareholder in the Ludwigs-Eisenbahn.

A reply was eventually received from Robert Stephenson & Co. saying that the line was admirably adapted to the use of locomotives and recommending "the smaller class we made for the Liverpool and Manchester R. Way Company." The price was given as £800 f.o.b. Newcastle, with £80 for a tender. The latter could, however, easily be made locally, they said. They quoted £2,525 for the ironwork for the track and warned against the use of a light permanent way. Two locomotives would be shipped free to Rotterdam for £1,700, a tender for £100. Robert Stephenson recommended a colleague as civil engineer, who would require £600 a year and his expenses out and home, with an interpreter at £200 per year. These last figures so alarmed the Nurembergers that they redoubled their efforts to find someone at home and were successful, just as they had given up hope, in meeting with a Bavarian Paul Denis, who had carried out public works and undertook to build the line. In spite of List's opinions the English form of permanent way was adopted, very fortunately, and sample parts were obtained from Newcastle.

Owing to the unbending attitude of the customs authorities it was necessary to find someone who would supply the parts in Germany, if possible, and Platner and Mainberger set off on a journey of investigation, which was to include the possibility of getting a locomotive built on the Continent. A firm named Holmes and Rolandson at Unterkochen offered to make one. It soon after moved to Wels, in Austria, under the name of Holmes and Strong and renewed the offer. The price approximated to Stephenson's, but it was felt that the firm had not enough experience in these matters. The rails being at last ordered from Remy in Neuwied, the travellers interviewed Cockerill at Liége, who were reported as being able to supply a locomotive, only to find they had never made such a thing. They continued on to Brussels and found themselves in the same hotel as George Stephenson, who was attending the preparations for the opening of the Brussels-Malines line. Conversations began and Platner and Mainberger were so impressed by a trial run on that line that they ordered a locomotive, "to weigh 6 tons and exert 10 horse power, for 750 to 800 pounds sterling, delivered at Rotterdam at the end of July." A written confirmation from Nuremberg dated May 19, 1835, asked also for the framework for one passenger and one goods vehicle, as models, with certain drawings and gauges. Michael Longridge had written for the Stephensons on the day before saying that Robert Stephenson considered the price would be £900, with frame and springs for a tender at £45. Twelve weeks would be required to complete. Scharrer replied to this, hoping the price would not finally be so high and saying they relied on the Stephensons to do their best in this respect. He was horrified at the time required to make the engine, for he and his colleagues had set their hearts on opening the line on August 25, the King's birthday. In a letter dated June 6, the makers stated that they would proceed with all possible despatch, but could not complete before the end of August. On July 14 they reported that "your locomotive engine is going briskly forward."

The question of gauge had, of course, to be considered. It had been planned to make it smaller than Stephenson's gauge, but the ordering of the locomotive changed the situation. Denis said he would have to make alterations which would increase the cost and entered a protest against the "Anglomania" of his committee, in this and other matters. Meanwhile, the building of the line was being pushed forward. Wrought iron rails about 5 m. long (16 ft.) were used and weighed about 120 to 150 lb. They were carried in chairs on stone blocks, with a layer of tarred felt between, resting in small stone ballast and sand. For part of the way, however, wooden cross sleepers were tried. As horses were to be used as well as the locomotive, the 4 ft. way was paved. The choice of a well built track proved amply justified by events, as the promoters themselves afterwards admitted.

At last on August 31, 1835, Robert Stephenson & Co. were able to write and advise that the anxiously expected locomotive had been sent off by boat to Rotterdam, accompanied by a man named William Wilson, who was to work it. The advisability of sending somebody for this purpose had been discussed with the makers, both personally and by correspondence, and they had advised that it would be



First public steam locomotive in Germany, built by Robert Stephenson & Co.

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necessary to pay £2 a week for a suitable individual. The agreement made between Robert Stephenson & Co. and Wilson was as follows:—

Newcastle upon Tyne,
Sept. 4th, 1835.

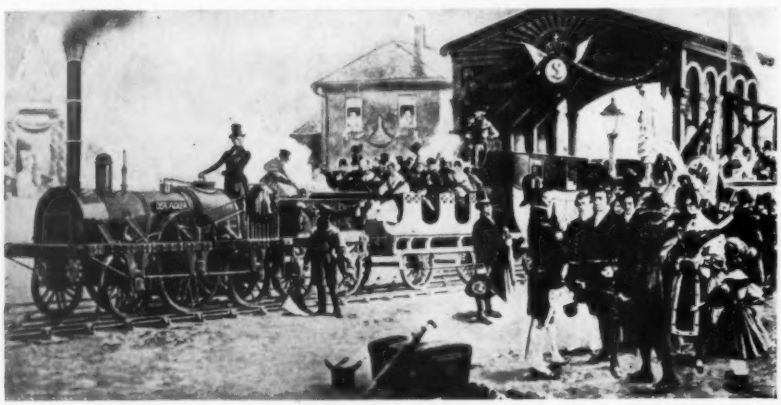
Mem(orandum) of Agreement between Mr. Wilson and Robert Stephenson and Co. That is to say: W. Wilson agrees to go to the Nuremberg Lewis Rail Road to work a Locomotive Engine made by the said Rob. Stephenson and Co. for Eight Months and to learn another person how to manage it and replace him for the sum of thirty-five shillings and forty shillings per week when the other person is receiving instruction.

The passage and expenses of the said W. Wilson to Nuremberg and on his return to Newcastle after the expiration of the above period to be paid by the Nuremberg Lewis Rail Road Company.

The working hours not to exceed 12 hours per day.

W. Wilson pr. pro. Robert Stephenson & Co.
Wm. Pearson.

The wages stipulated had been known ever since the interview with George Stephenson at Brussels, so their, for the time, princely level no longer surprised the railway owners. The limitation as to hours of work is interesting inasmuch as the Germans themselves had to wait 40 years before they obtained a similar concession. The difficulties of getting the locomotive to its destination were very great and much bother was experienced at the various customs barriers. Wilson was charged with the management of all these transactions, but found himself somewhat at a disadvantage through not knowing a single word of German. However, he reached Nuremberg on October 23 and four days later the locomotive arrived also, to the delight of its enthusiastic owners. Its workmanship, which was no doubt first class, was greatly admired and Platner was later able to announce that "several experts were unanimous in declaring the price of £850 to be reasonable." (The makers had reduced the quoted figure of £900 to £850.)



View of inaugural train headed by "Der Adler" leaving Fürth on December 7, 1835

Wilson lost no time in assembling the engine, getting it into working order and making some trial runs. There was some delay due to bad weather, which still further tried the patience of the Nurembergers, who had named their new possession *Der Adler* (The Eagle), but at length all was ready and the opening of the railway was fixed for December 7, 1835. Nine passenger cars had been provided, three 1st, four 2nd, and two 3rd class, built for the most part in Germany with the aid of patterns and drawings from England. Some confusion was created, it would seem, from the failure to indicate any scale on the drawings. The total costs for the locomotive and its freight to destination came to 13,930 fl. (23,877 RM.) and for the carriages 10,444 fl. (17,901 RM.). For a few days before the opening the public had been allowed to ride in the trial train and the fares charged were given to the poor. A general meeting was held the evening before and Platner expressed the admiration felt for the locomotive. "The acquisition of the steam engine, named by us *The Eagle*, has greatly delighted us and we feel much satisfaction in having found such a generally admired piece of craftsmanship, with its hundreds of parts, so suited to the requirements of our railway and assembled in three weeks."

At 8.0 a.m. on the opening day a large company of notabilities assembled on a decorated tribune, with the officers of the company. Regierungspräsident Stichauer represented King Ludwig. After a speech by Mayor Binder a commemorative stone was unveiled and the opening journey, with 200 guests in the nine carriages, began to the sound of a cannon. The scene has been represented in the well-known painting by Heim, in which the Englishman Wilson, in tall hat and tail coat, appears on the footplate and forms, in spite of the eminent persons around, the centre of the occasion. The run took 9 min., the return journey 11 min. The dinners and festivities common to such events were duly held and Germany's first public railway entered on its useful career next day, December 8, 1835.

The first timetable comprised two steam and three horse hauled trains each way daily, but on March 14, 1836, an hourly service was instituted, between 8.0 a.m. and 7.0 p.m.; after that hour extra horse drawn trains were run to suit theatre and concert goers, amidst the violent protests of the Fürth cabmen. The fares for both kinds of train were the same, namely: (single journey)

1st class,	12 Kreuzer	= 34 Pf.
2nd ,,	9 ,,	= 25 Pf.
3rd ,,	6 ,,	= 17 Pf.

(1 Pf. $\frac{7}{2}$ = $\frac{1}{10}d.$ at par, approx.)

Children over 8 were charged full fare. In 1836 449,399 passengers were carried. There was no goods traffic at first but on July 7, 1836 the first consignment of two casks of beer (!!) was conveyed from the Lederer Brewery at Nuremberg. A regular cattle and goods traffic soon followed and then postal traffic was conveyed. The results of the first year's working enabled 19 per cent. dividend to be paid. The original capital had had to be increased to 212,500 fl. (364,225 RM.), by means of new shares and a loan, but still the results were excellent. From 1836 to 1844 the average dividend was 16½ per cent., and for the period 1836/1890 it was 17½ per cent. The shares soared and reached a premium of 500 per cent. at one time. The traffic increased constantly as the towns grew, as the following numbers show:—

Year.	Passengers carried per annum.
1835 to 1850	450,000 to 500,000
1871	1 million.
1893	2 do.
1904	3 do.
1908	4 do.
1919	over 4½ millions.

Horse traction was finally given up in 1862.

The results obtained induced Platner to write on January 16, 1836, to Robert Stephenson & Co. and inquire about a second locomotive. They replied on January 30 that they could furnish one with tender for £1,015 delivered Rotterdam and have it ready in May if ordered at once. The increased price was said to be due to the rise in the cost of materials. This engine was ordered and arrived in

Hamburg in July, 1836. On its reaching Nuremberg it was named *Pfeil* (Arrow) and was set to work by Wilson. Both it and *Der Adler* gave complete satisfaction and they worked till 1853 and 1857 respectively, when they were sold for scrap, nobody thinking to preserve them as of historical interest. All subsequent locomotives were ordered in Germany, the first coming from Henschel at Kassel in 1851.

William Wilson had, as we have seen, agreed to stay for eight months at Nuremberg, but the ordering of another engine induced the company to make an agreement with him to stay as long as necessary. Some of the terms were as follow:—

> Mr. Wilson binds himself to the service of the said railroad company for as long time as they wish or find in their interest to keep him in their service: in contrary case they must give him three months previous notice. . . .
> Further Mr. Wilson engages not only to the management and inspection of the locomotive and to continue in the repair of the engines that may occasionally occur and to instruct the apprentice Rech till he is able, in cases of need, to perform the business of a conductor of the locomotive, but also
> 1. to do the same business with the second locomotive that is shortly to arrive
> 2. after the construction of a workhouse for the purpose of the company to take over himself the management of the said workhouse, the repair, when their's need, of the locomotives and the transport-waggons, as far as such reparations can be made in the workhouse.
> 3. to bind himself to the inspection of all transport waggons and the ironworks of the rail and to order any reparation or do so himself
> 4. to instruct some young men in the conducting and management of the locomotives in order to be supplied, in any case of need, with such individuals as may replace him."

(The peculiar wording in places was due to the document being drawn up by a Herr Gambihler, teacher of languages.)

The company in return agreed to pay Wilson 1,500 fl. (roughly £128) per annum. It has been stated that "the engine driver had more money than the manager," but Wilson was in reality a locomotive superintendent and also permanent way inspector. Such a salary was high for those days, but wages in general were good on this railway and Wilson's abilities were, for the times, of a very special nature. He never quitted the service. In 1843 it was proposed to dispense with him, but many wished him to remain and various agreements were concluded from time to time with him, the salary fluctuating between 1,000 and 1,200 fl. His health began to fail in the late 'fifties and he died on April 17, 1862. That he had made himself highly respected is shown by the circular announcing his death and funeral sent to the directors and staff, in which the Manager "begs his colleagues to assemble with him in right goodly number to show the last respects to so worthy and deserving a servant of the company."

The little Ludwigs-Eisenbahn never became part of a great European trunk line, as was fondly hoped at the outset. As the district around altered, it failed to meet all its wants and a horse tram line was laid alongside it in 1881. This was electrified in 1898 and greatly improved in 1913. The removal of a gas works near the Nuremberg terminus gave a blow to freight traffic and the war increased the difficulties of the line. It was closed in October, 1922, and was re-opened as a high speed electric line in August, 1926, under lease to the city of Nuremberg. For three-quarters of a century it had been among the best paying undertakings in Germany and reflected much credit on its promoters.

Much interesting literature is now appearing in Germany in connection with the centenary celebrations and we are indebted to Herr Stumpf's valuable article in *Archiv für Eisenbahnwesen* and the special number of the *Zeitung des Vereins Mitteleuropäischer Eisenbahnverwaltungen* for many of the details in this article.

BALE STACKING TRUCKS AT FRIZINGHALL, L.M.S.R.

TWO B.E.V. bale stacking trucks, manufactured by Wingrove & Rogers of Liverpool, have recently been installed by the L.M.S.R. at Frizinghall (Yorkshire) depot. They are so designed as to pick up, elevate, stack, and convey bales of wool or other similar merchandise, and are also capable of reclaiming bales from the stack and delivering them to any point required. All these operations are performed by one man who travels on the truck, as shown in our illustration. The trucks, which will pass through a doorway 7 ft. high and 3 ft. 8 in. wide, are constructed to lift bales up to 5 cwt. each, of a size averaging 2 ft. 6 in wide by 2 ft. 6 in. high and 5 ft. long, and to stack these bales five tiers high. Carrying a full load, the trucks will travel at 5 m.p.h. on the level and will lift 5 cwt. at an average speed of 1 ft. a second.

Brakes are fitted on the two driving wheels and are normally "on" until the pedal is depressed by the operator standing on the truck platform. An automatic solenoid brake, operating on the worm shaft of the winding drum, holds the load in any intermediate position when the power is off. Power is supplied from a 32-volt Exide battery of 16 cells, 161 ampère-hour capacity, fitted in an easily accessible withdrawable box between the two axles.

The motors, which are 1·4 h.p. for hoisting and 1·0 h.p. for travelling, are fitted on the steel framework; they are of the totally enclosed type, series wound, rated at one hour and built in accordance with British Standard Specification No. 168. The hoisting motor is connected to the

B.E.V. truck stacking bales of wool at Frizinghall depot, L.M.S.R.

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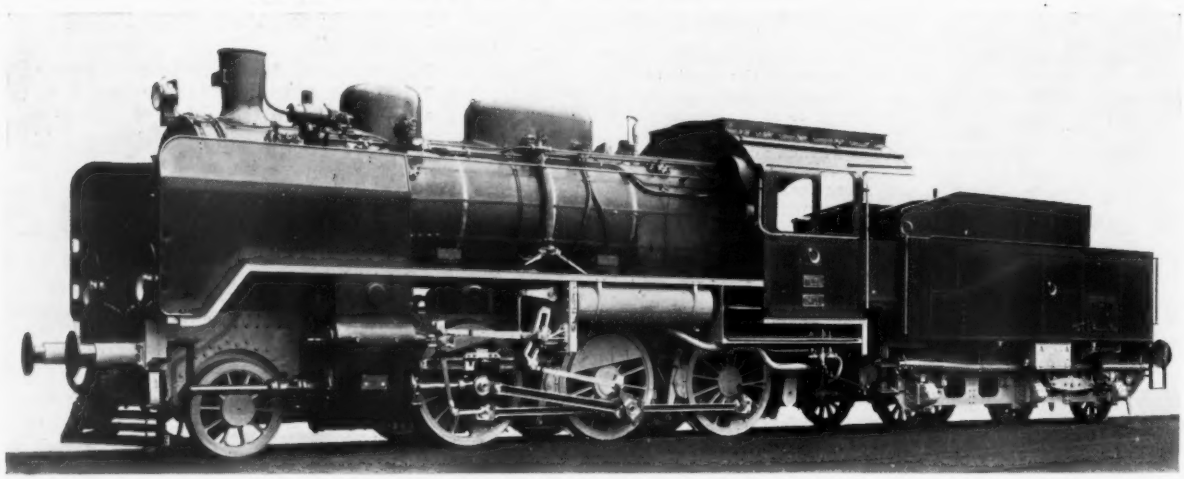
winch by an enclosed worm reduction gear. The travelling motor drives the road wheels through roller chains.

Two drum type controllers operate these motors; these are fitted with spring return handles so that they will always return to the " off " position when released. An automatic limit switch is provided to cut off the power at the upper travel limit of the lifter. The batteries will operate the truck under average conditions of lifting and travelling for 6 hours on one charge. They are accommodated in a substantial container which is easily removable so that a discharged battery can be changed in a few minutes. The batteries are charged from any town supply through a motor generator set, which converts the 400 volts 3 phase 50 cycle alterating current supply to 50 volts direct current. We are indebted for the foregoing description and illustration to Mr. C. R. Byrom, Chief Operating Manager, L.M.S.R., to whose requirements the equipment has been installed under the supervision of Mr. C. E. Fairburn, Electrical Engineer, L.M.S.R.

A 2-6-0 HENSCHEL LOCOMOTIVE FOR TURKEY



WE have received from Henschel & Sohn A.G., of Kassel, photographs and particulars of a 2-6-0 type engine with six-wheeled tender, which that firm has recently supplied for passenger service on the Turkish State Railways. This has in its design features characteristic of German practice for the same class of locomotive. The cylinders, as seen, are placed outside the frames, with piston-valve steamchests above them; steam distribution is by Walschaerts valve motion.

The engines are built for the 4 ft. 8½ in. gauge and the axle load is restricted to 15·9 metric tons (15 tons 13 cwt.). A maximum speed of 75 km. (46·6 m.) p.h. and a minimum radius of curve of 200 m. (656 ft.) are allowed for.

The engine in working order weighs 59·2 metric tons (58 tons 5 cwt.), of which 47·5 metric tons (46 tons 15 cwt.) are available for adhesion. The tender, in working order, weighs 45·4 metric tons (44 tons 13 cwt.), and has a water capacity of 16·5 cu. m. (3,630 gallons) and a fuel capacity of 7·0 metric tons (6 tons 18 cwt.). The engine develops a tractive effort of 11,466 lb.

The following are the main particulars:—

Cylinders, dia.	500 mm. (19 11/16 in.).
,, stroke	660 mm. (26 in.).
Coupled wheels, dia.	1,400 mm. (4 ft. 7⅛ in.).
Leading (bissel) wheels, dia.	1,000 mm. (3 ft. 3⅜ in.).
Wheelbase, rigid	3,800 mm. (12 ft. 5⅝ in.).
,, total engine	6,500 mm. (21 ft. 3⅞ in.).
Boiler, working pressure	13 at. gauge (184·8 lb. per sq. in.).
Boiler heating surface, tubes and flues	101·0 sq. m. (1,086·7 sq. ft.).
,, ,, ,, superheater	38·0 sq. m. (408·9 sq. ft.).
Total	139·0 sq. m. (1,495·6 sq. ft.).
Grate area	2·0 sq. m. (21·52 sq. ft.).

Linking Iraq with Turkey

Press reports from Baghdad state that an important agreement was reached on July 19 between the Iraq Government and the directors of a company called B.O.D. Limited, of which Lord Glenconner is Chairman. Under this agreement the company is granted a concession to build a railway linking the Iraq and Turkish systems. It is further stated that, although the main purpose of the railway will be the conveyance of oil from the company's concession areas south of Mosul to the Mediterranean, the line will also serve to link Baghdad and Mosul with the Taurus Railway across Asia Minor to Istanbul. Presumably the new link will be between Tel Kotchek (to which point the Syrian authorities recently extended the Taurus Express route from Tel Ziouane) and Sharqat via Mosul, following the alignment laid out before the war by the German company then building the Baghdad Railway. This would complete a standard gauge line to Baghdad. At present motorcars link Tel Kotchek with Kirkuk, the northern terminus of the Iraq metre-gauge line to Baghdad and Basra. The Reuters correspondent states that, although the registered name of the company is B.O.D. Limited (signifying British Oil Development Company), German interests hold 40 per cent. of the existing share capital, and Italians 36 per cent., while the remaining 24 per cent. are divided among British, French, and Swiss financiers.

RAILWAY NEWS SECTION

PERSONAL

Mr. William Burton Carson has been elected Chairman of the Great Northern Railway, Ireland, and the Rt. Hon. Lord Glenavy has been elected Deputy Chairman. The vacancy on the board caused by the death of Sir Lingard Goulding, Bart., will not be filled.

It is with regret that we note the recent death in Costa Rica, of Mr. F. Witting, a Director of the London board of the Costa Rica Railway Co. Ltd. from 1896 to 1920, and General Agent in Costa Rica from 1920 to 1933.

INDIAN RAILWAY STAFF CHANGES

Mr. J. Mackinnon, Deputy Agent, N.W.R., has been appointed to officiate as Chief Engineer on that railway, as from May 13.

Mr. D. Dutt has been appointed to officiate as Deputy Agent, N.W.R., from May 13.

Mr. R. M. Sinha, officiating Deputy Chief Engineer, Signals, E.I.R., has been confirmed in that appointment, as from February 5.

Mr. L. P. Misra, Deputy Agent (Provisional), E.I.R., has been appointed to officiate as Divisional Superintendent on that railway, as from May 30.

Rao Bahadur R. S. Iyer has been appointed Deputy Chief Accounts Officer, G.I.P.R., as from May 6.

Rai Bahadur B. D. Puri has been appointed to officiate as Chief Accounts Officer, N.W.R., as from June 7.

Mr. C. A. K. Bradley, Officiating Deputy Chief Mechanical Engineer, E.B.R., has been granted six months' leave, as from June 21.

The Ministry of Transport has appointed Alderman G. E. Caine for the remaining period of three years from February 1, 1934, as a member, representative of the interests of local authorities in England and Wales, on the Transport Advisory Council established under the Road and Rail Traffic Act, 1933, to fill the vacancy caused by the resignation of Sir Percival Bower. Alderman Caine was elected a member of the Rotherham County Borough Council in 1906 and created an Alderman in 1920. He is an ex-Mayor of that Borough, a Freeman of the Borough, and has been a member of the Transport Committee of the Council since 1913, and Chairman of that committee since November, 1927. He was appointed a Justice of the Peace in 1913.

Mr. Alexander Muirhead, C.I.E., late Chairman and Managing Director of the South Indian Railway, whose death we recorded in our issue of July 19, joined the Oudh and Rohilkhand Railway Company in 1884 as Assistant Traffic Superintendent (Commercial). When that railway was taken over by the Government, Mr. Muirhead's services were transferred with it, and he was promoted to be a District Traffic Superintendent, and subsequently Superintendent of the Line. In 1893 he left Government service to take up the appointment of Traffic Manager of the Southern Mahratta Railway, and in 1897 he joined the Great Indian Peninsula Railway as General Traffic Manager. This position he occupied for fourteen years, and he was then appointed Agent and General Manager of the South Indian Railway in 1911. He retired from Indian service in 1920 and was elected to the Boards of the Great Indian Peninsula and South Indian Railway Companies, and in the following year also became Managing Director of the latter. It was in 1924 that he was elected Chairman of the South Indian board, but he continued to carry on at the same time the duties of Managing Director.

Phot.] [Elliott & Fry

The late Mr. A. Muirhead, C.I.E.,
Chairman and Managing Director, South Indian Railway, 1924–1935

Mr. Muirhead was President of the Indian Railway Conference Association, and a Member of the Legislative Council of Madras. He also served as a member of two dock commissions to inquire into the working of Kidderpore Docks and the Karachi Port Trust, and was on the committee of the Indian Chamber of Commerce. At the Royal Durbar at Delhi, in 1911, Mr. Muirhead was decorated by the King with the order of C.I.E.

Mr. S. McEwen has been elected a Director of Mitchell Engineering Limited.

Messrs. G. Henderson and C. O. Parker, Accountants, have been appointed, by the Secretary of State for the Colonies, to be Staff Accountants, Gold Coast Government Railway.

Mr. P. B. Wilson, Chief Accountant, Southern Railways of Peru, returned from leave in Europe on May 10.

Mr. R. Flack, Chief Accountant, Central Argentine Railway, returned to Buenos Aires from leave on June 18.

Mr. J. C. Somerville, Traffic Manager, Buenos Ayres & Pacific Railway, sailed for England on leave on June 12.

Mr. Frank Henderson, late Chairman of the Central Uruguay and other railways, whose death we recorded on June 28, left estate valued at £46,159 (£26,815 net).

It is with regret that we have to record the death in London, on July 19, at the age of 85, of Mr. Francis Roxburgh, B.A., LL.M. A son of the late Sir Francis Roxburgh, Q.C., Judge of County Courts, he was educated at Harrow, and at Trinity Hall, Cambridge, of which he was a scholar and law prizeman. He was called to the Bar at the Middle Temple in 1873, and in 1887 was appointed Assistant Judge of the Lord Mayor's Court, but retired from that office in 1900. Mr. Roxburgh will be much missed from the annual meetings of the Great Western Railway Company, at which he had been a prominent and valued speaker from 1921 onwards. He had an unfailing belief in the future of the company, and supported its policy with eloquence and discrimination, particularly the decision of the directors to maintain the dividend by utilising reserves. His useful activities on behalf of the shareholders received on

different occasions public acknowledgment from the Chair, and the repeal of Railway Passenger Duty was undoubtedly the result of his persistent propaganda.

The funeral service was held on Monday, July 22, at St. James's Church, Paddington. Among those present were:—

Mr. R. F. Roxburgh, K.C. (son); Sir Felix Pole; Mr. H. E. Hedges, also representing Sir James Milne, General Manager, Great Western Railway; Mr. W. A. Knock, representing Mr. F. R. E. Davis, Secretary, Great Western Railway; Mr. Martin Campfield; Mr. W. W. Legg, Assistant Editor, also representing Mr. J. A. Kay, Editor of THE RAILWAY GAZETTE.

Consequent upon the death of Mr. Alexander Muirhead, C.I.E., announced in THE RAILWAY GAZETTE of July 19, Sir Ernest A. S. Bell, C.I.E., has been appointed Chairman and Managing Director of the South Indian Railway, and Sir Percy Rothera, O.B.E., has been elected to fill the vacancy on the board.

The Council of the British Electrical and Allied Manufacturers' Association has decided to place the entire control of the Beama management in the hands of Mr. V. Watlington, who has been a Joint Director since 1932. Mr. C. Rodgers, Secretary of the Association since 1921, has been appointed Deputy Director.

Sir Harold Hartley, C.B.E., F.R.S., Vice-President of the London Midland & Scottish Railway, who has also recently been elected Chairman of the British National Committee of the World Power Conference, has been elected Chairman of the International Executive Council of that conference, in succession to the late Mr. D. N. Dunlop, its founder, whose biography appeared in our issue of June 14, accompanied by an editorial note in which his connection with, and some of the activities of the World Power Conference were outlined.

Mr. F. W. Box, Acting Chief Engineer, Construction, Victorian Government Railways, has been appointed Chief Engineer to the Grain Elevators Board.

Mr. G. T. Wilson has been appointed Transportation Superintendent, New Zealand Government Railways, with headquarters at Wellington. Mr. Wilson joined the railways as a cadet at Dunedin in 1899, and occupied various positions in that district until 1917, when he was transferred to headquarters at Wellington. In 1924 he was appointed Chief Clerk in the Commercial Branch of that office, and in 1927 he filled the position of Senior Business Agent. For a brief period in 1929, Mr. Wilson was detailed for special duties in the head office, and in 1931 he became Assistant District Traffic Manager, Wellington. He occupied this position for a year, and was then appointed District Traffic Manager, Auckland, which position he has filled up to the date of his present promotion.

Mr. G. T. Wilson,

Appointed Transportation Superintendent, New Zealand Government Railways

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Mr. R. McClelland, Staff Officer, Transportation Department, Victorian Government Railways, has retired after 37 years' service in various divisions of the Transportation Staff office, 48 years in the department, and 15 as Staff Officer.

The late Mr. J. P. Scott Main, whose death on July 14 we mentioned in our last issue, was buried at Woking on Thursday, July 18. Additional to many relatives and personal friends, there were present:—

Sir John Pringle (late Chief Inspecting Officer of Railways), Mr. E. W. Rowntree (Assistant Secretary, Ministry of Transport), Colonel Mount (Chief Inspecting Officer of Railways), Mr. J. L. M. Moore (Assistant Inspecting Officer of Railways), Mr. W. Worthy Cooke (Sub-Inspecting Officer of Railways), Mr. H. Kimber (for many years Mr. Main's personal Clerk), Colonel Hall (Assistant Engineer Signals and Telegraphs, Southern Railway), Mr. A. D. Jones (Locomotive Running Superintendent, Southern Railway), Mr. J. E. Sharpe (Divisional Superintendent, London, West, Southern Railway), Mr. F. N. A. Humphreys (National Union of Railwaymen). Colonel Pickard (General Secretary, National "Safety First" Association) had intended to represent that body, but, at the last moment, had to request Mr. Moore to also act on behalf of the Association.

We regret to learn of the death, in an aeroplane accident on July 20, of Commander A. G. Watts, D.S.O., R.N.V.R., whose advertising work for the L.M.S.R. and drawings for "Punch" are so well known. Born in 1883, he was educated at Dulwich and trained at the Crystal Palace Poster Academy—of which he was a medallist—in Paris and at the Slade School. His black-and-white work was that of a genius, and thoroughly characteristic, being backed by a humour and human sympathy that could not be concealed. He also did some poster-work for the Underground group, but will be specially missed in connection with his work for the L.M.S.R.

Below we reproduce two specimens of Commander Watts's work for the L.M.S.R. Mr. G. H. Loftus Allen, Advertising and Publicity Officer of that railway, has sent us the following appreciation:—

"A man of the most engaging personality and charming character is

Specimens of the work of the late Commander A. G. Watts for the L.M.S.R.

taken from us by the untimely and tragic death of Arthur Watts.

"For nearly ten years Watts had been engaged on various kinds of artistic work for the L.M.S.R. His first designs for us were a series of coloured posters of railway servants, which were done in co-operation with E. V. Knox ("Evoe"), who wrote an appropriate verse for each drawing.

"Later Watts turned his talent for black and white drawings to press advertising. Five years ago he designed illustrations for the L.M.S. advertising in the American and Canadian press, and these received such universal commendation that thereafter until the present year he did all the drawings for the L.M.S. holiday area advertising schemes. Since the operation of the L.M.S. and L.N.E. Pool, the sketches for the joint Scottish advertising had also been done by him.

"So great was the public appreciation of his work and so frequent were the requests from the public for copies of his advertisements that extra 'pulls' of these had to be printed in order to meet the demands. A new quad royal poster of the Lake District designed by Watts appeared early in the present year, and stands as a typical example of his power to combine mastery of design with whimsicality of humour.

"No artist with whom we came into contact was ever readier to appreciate our point of view or to mould his ideas to our requirements. To know him was a privilege, to work with him a pleasure. The many friends whom he made on the L.M.S.R. will find it hard to realise that they are robbed for ever of his genius and charm."

We regret to note the death, on July 17, of Sir William Calthrop Thorne, Solicitor to the Mersey Docks and Harbour Board from 1900 to 1925, and afterwards Consulting Solicitor until 1932. Up to last year he was Honorary Secretary to the Dock and Harbour Authorities Association.

SOUTH AFRICAN RAILWAYS STAFF CHANGES

Mr. W. Heckroodt, Staff Controller, to be Superintendent (Staff), Headquarters.

Mr. P. T. Steyn, Manager, Road Motor Services, to be Superintendent (Operating), General Manager's Office.

Mr. J. Rogan, Superintendent (Operating and Commercial), Pretoria, to be Manager, Road Motor Services, Johannesburg.

Mr. G. H. Dawson, Superintendent (Operating and Commercial), Bloemfontein, to be Superintendent (Operating), Capetown.

Mr. R. J. O. Armstrong, Private Secretary to the General Manager, to be Assistant Superintendent (Special Duties, Parliamentary).

Mr. C. H. Hamilton, Goods and Passenger Superintendent, Port Elizabeth, to be Superintendent (Operating and Commercial), Kimberley.

Visit of the Dominion Parliamentary Delegation

On the occasion of the visit to this country of a delegation from the Dominion Parliaments, the Central Legislature of India, and certain of the Colonies, the Empire Parliamentary Association co-operated with the British railways in arranging for the visitors an industrial tour of Great Britain extending from July 18 to 31, covering England, Scotland, and Wales. In a printed greeting to the delegation, Sir James Milne (General Manager, G.W.R.), Sir Josiah Stamp (Chairman and President of the Executive, L.M.S.R.), Sir Ralph L. Wedgwood (Chief General Manager, L.N.E.R.), and Sir Herbert Walker (General Manager, Southern Railway), said:—

The visit of the delegation to the United Kingdom, in the historic year which marks the Silver Jubilee of His Majesty King George V is one of crowded days. Not only has the delegation paid its loyal addresses to His Majesty, but it has made its visit the occasion for a first-hand study of the political and economic problems which are vital to the Empire as a whole. In the industrial tour of Great Britain which the delegation is now undertaking, the British railways, themselves the largest industrial undertakings in the country, are happy to play their part.

The British railways are mindful of the extent to which their own well-being is bound up with trade between the Home Country and all parts of the Empire. They hope this booklet will serve as a memento, not only of a pleasant and instructive tour around the principal industrial centres of the country, but of the essential link which they themselves provide in the system of Empire transport.

Previous to the departure of the delegation to Scotland on July 25, a special exhibition of the latest railway freight rolling stock was arranged at Euston station. This exhibition included eleven of the latest types of containers for the door-to-door delivery of such diverse commodities as meat (in ventilated or insulated containers), soft fruit, grain in bulk, cycles, glass bottles, boots and shoes, groceries, furniture, bricks and tiles, &c. Seven open wagons included 20-ton end, side and bottom door vehicles for the conveyance of coal traffic, a 50-ton brick wagon capable of conveying 20,000 bricks, and vehicles for the carriage of heavy and unusually lengthy articles.

The covered wagons comprised a refrigerated meat van, banana van, bulk grain van, and a special van for the carriage of motor bodies from works. In addition, vehicles specially constructed for the conveyance of exceptional loads were on show, including a 65-ton bogie well trolley for the conveyance of engines for shipment abroad; a 70-ton twin girder set designed for the purpose of carrying bridge girders approximately 120 ft. long and 11 ft. high; a 20-ton well glass wagon for carrying large cases of glass, shop window frames, sectional huts, and similar freight; a 20-ton well wagon for the conveyance of excavators, steam-rollers, traction engines, and so on; a 120-ton side girder wagon for transformers or heavy machinery, as well as the largest railway wagon in Great Britain, or rather, set of wagons, comprising a 110-ton well trolley wagon, two 60-ton flat wagons, and two 20-ton trolley wagons. The 110-ton wagon is capable of carrying a self-contained load of 150 tons, but a cantilever arrangement is used to spread the weight over 56 wheels. This set of vehicles is used for the conveyance of such concentrated loads as electric stators, ingots, anvil blocks, and so on.

Later in the day the vehicles were inspected by a number of traders, who were invited in co-operation with the Association of British Chambers of Commerce, the Mansion House Association on Transport, the Federation of British Industries, and other trading organisations.

Parliamentary Notes

Anglo-Indians and Indian Railways

During the report stage in the House of Lords of the Government of India Bill,

Lord Lloyd, on July 18, moved an amendment to clause 241 (Recruitment of service in the railways). The amendment provided that in recruitment generally for railway purposes the Federal Public Services Commission should have due regard to the past association of the Anglo-Indian community with railway services in India. His Lordship said that owing to the policy of Indianisation the Anglo-Indian community had been gravely affected. He had now been informed that instead of being allowed to retain their present positions in the railway services they were to be scattered over the minor jobs.

Lord Hardinge said that ever since the Mutiny the Anglo-Indians had always stood by this country and we should not ignore our responsibilities to them.

The Marquis of Zetland (Secretary of State for India) said he was having the complaints of penalisation against Anglo-Indians referred to the Government of India, and he had asked for a report. The Government had every intention of carrying out the undertaking which they had given to the Anglo-Indian community. He was prepared to look further into the matter. He sympathised with Lord Lloyd's object, but he feared that the insertion of this amendment might create some prejudice against Anglo-Indians. He suggested that further consideration should be given to the matter so that words might be found that were designed better to achieve Lord Lloyd's object.

Lord Lloyd, in view of the assurance, withdrew his amendment.

XUM

RAILWAY AND OTHER MEETINGS

EGYPTIAN DELTA LIGHT RAILWAYS LIMITED

The ordinary general meeting of the Egyptian Delta Light Railways Limited was held at Winchester House, Old Broad Street, E.C.4, on July 19, Sir Montagu Sharpe, K.C. (Chairman of the company) presiding.

Mr. F. R. Parker (Secretary) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, remarked that at the last meeting he had mentioned the importance to Egypt of the cotton crop, and of fluctuations in the price of the commodity. In 1934 cotton had been attacked by the leaf worm, and extensive damage done, the results of which made themselves felt in the goods receipts for the period under review. More passengers had been carried, but the rise in takings was not commensurate with the increased numbers owing to the low fares charged.

Of late years the company had had to face the anxiety of road competition, and this was now aggravated by the smaller volume of traffic caused by economic conditions. Road competition was increasing, and was often extremely wasteful. The company was subject to stringent conditions as to the running of trains, but bus operators were free to plan their schedules as they pleased. It was difficult to meet this competition without reducing fares to uneconomic levels. Moreover, the company was obliged to run trains on some definitely unremunerative branches. The railway had therefore decided that it must itself operate motorbuses on all routes parallel to its lines, as well as in rural districts where a train service was not economically justified. The Government was sympathetic and had granted permits for 55 buses, six of which went into service a few weeks ago; Twenty-nine would be ready in about a month's time, and the rest would be built as soon as possible.

The number of passengers carried in 1934-5 increased by 1,424,776, and receipts from this source by £7,357. Tonnage of goods lifted was 30,308 tons better, but revenue fell by £3,595. Cotton traffic produced £5,500 tons less owing to the poor crops and road competition. Receipts from building material, gravel and sand improved. Expenses, at £185,751, were lower by £5,336. The result had been achieved only by scrupulous attention to detail. Outlay had been restricted to essential maintenance and the purchase of a diesel shunting locomotive. Considerable capital expenditure would, however, be involved by the motorbus programme, although the precise extent could not be estimated until it was known how far the Government was prepared to go in the granting of licences.

After meeting all fixed charges and providing for transfer to reserve, the net earnings of the company were £14,333, and the directors recommended payment of a dividend of 1 per cent., amounting to £10,408, on the preference shares. The Chairman also announced that in future, owing to exchange complications, payments to holders of the 3½ per cent. Est bonds would be made at the equivalent of the sterling figure named on the bond or coupon.

As to the current year, the inauguration of motorbus services was the most important factor. The Government had abolished the cotton tax, and this should assist exports and benefit the farmer. Legislation had also been introduced to prohibit the practice of mixing different varieties of cotton, which would enhance the reputation of the commodity abroad. The depredations of the leaf worm, however, were worse than before, but the Ministry of Agriculture had assisted in the organisation of defensive measures. The fight with the cotton worm had been officially proclaimed as a national duty.

In conclusion, the Chairman said his remarks would be incomplete without reference to the services rendered to the company during the year by Lt.-Col. J. R. Marryatt, the Agent in Egypt, and by Mr. F. R. Parker, the Secretary.

Replying to the question whether the company's new road operations would embrace goods as well as passengers, the Chairman explained that they affected passenger transport only, since the railway had been making use of motor lorries for some time. Another shareholder said he considered the motorbuses would not be of much benefit unless used as an instrument to discourage competition. As a mere means of earning money they would not be more profitable than the means already possessed. Much technical skill was required to gain benefit from such a measure. He thought that the ravages already experienced and again forecast as a result of the depredations of the cotton insect might not make the present a very suitable opportunity for embarking upon innovations of this kind.

Answering these points, and also the question whether in its negotiations with the Government the company had pressed for the regulation of road transport, the Chairman said that all that had so far been obtained was a permit, renewable annually, for each bus, but it was hoped soon to get a concession covering the whole fleet. He thought that the company's buses would be able to stand on their own merits, since most of those with which they were competing were of a very low standard of comfort. The services would be run from village to village, and from village to station.

The motion was then put to the meeting, and the report and accounts unanimously adopted. The Chairman then proposed the payment of a dividend of 1 per cent., less income tax, on the preference shares, and this was likewise carried. To conclude the business of the meeting, Sir Montagu Sharpe and Mr. F. G. Bonham Carter, having retired by rotation, were re-elected directors of the company.

In moving a vote of thanks to the Chairman, a shareholder took the opportunity of saying a cautionary word about motorbus services. The whole matter seemed to him to depend upon whether or not regulation of road transport was secured. If it was, the buses would be a fine thing. Otherwise, the company would have to contend with economically minded natives who bought their equipment by the cheapest means, and who kept their overhead expenses down to the barest minimum.

BOMBAY, BARODA AND CENTRAL INDIA RAILWAY COMPANY

The ordinary general meeting of the Bombay, Baroda and Central India Railway Company was held at Southern House, Cannon Street, E.C., on Wednesday last, Major A. D. G. Shelley, R.E., Chairman of the company, presiding.

Mr. S. G. S. Young (Secretary) read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, explained that the only change in the mileage figures shown in the report was due to the Palanpur-Deesa Railway being now wholly the property of the Palanpur State, and being therefore included as a worked line. Notice had also been received that the administration of the Jaipur State Railway would be taken over by that State on April 1 next.

Somewhat higher capital expenditure had been necessary during the year under review, principally on bridgework and on the development of the new colliery at Kurasia. It was expected that the new bridge over the Nerbudda River at Broach, the most expensive item in the bridge programme, would be opened for traffic before the end of the year. The Kurasia Colliery was already producing about 200,000 tons a year, and was being equipped for an annual output of 250,000 tons.

The net revenue account again showed an increase in gross earnings, this time of Rs. 36 lakhs as compared with one of Rs. 43 lakhs in the preceding year. An improvement in freight takings fairly well spread over all classes of traffic was mainly responsible, but it was satisfactory to note that passenger earnings were also responding to the improved trade conditions.

The Chairman had remarked at the previous meeting that the policy of retrenchment would have to be followed in 1934-35 by a larger programme of

replacement and renewals, the result of which he now stated to be an increase of 9 per cent. in expenditure. Allowing for the rise of 3½ per cent. in gross receipts, net earnings were down by about 3½ per cent. on the preceding year.

Extension of the existing electrified suburban section of the railway between Bombay and Borivli for an additional sixteen miles to Virar was now in hand, and should be completed in March next. It was hoped that the whole scheme would give as satisfactory results to the public and the company as had been experienced from the electric services already operating since 1928.

Turning to the balance sheet, the Chairman said that the balance on stockholders' revenue account was nominally £175,224, but the actual value on March 31 last of the investments held on that account was £226,940, and this constituted the reserve which was maintained for dividend equalisation purposes and other special expenditure. A credit had been made to the London Staff Gratuity Fund, concerning which the Chairman explained that as a considerable number of retiring gratuities would have to be paid when the company's contract was terminated, it was thought advisable to average the cost of such payments by means of a fund created by yearly grants from the stockholders' revenue account, instead of by debiting them direct to that account as in the past. A resolution to that effect would be put to the meeting.

Receipts for the year under review had been sufficient to cover the 6 per cent. dividend recommended, and that rate had thus been maintained, with the help of the reserve fund in lean times, for fifteen consecutive years, a fact encouraging the hope that it might be possible to keep the record up for the few remaining years of the company's contract. Shareholders were aware that the Secretary of State had the option of terminating the contract on December 31, 1941, on repayment of the company's capital at par.

The report and accounts were unanimously adopted.

The Chairman then put to the meeting resolutions regarding the declaration of a dividend of 6 per cent. on the capital stock for the year ended March 31, 1935, and the opening of a London Staff Gratuity Fund. Sir Henry Burt seconded. The resolutions were carried unanimously. Also on the motion of the Chairman, seconded by Sir John Wardlaw-Milne, Colonel W. V. Constable, R.E., and Major-General Sir Henry F. E. Freeland, K.C.I.E., C.B., were re-elected directors.

Mr. K. Stacy proposed, and Mr. B. Parke seconded, the re-election of Mr. H. McClintock Harris as an auditor of the company. This was unanimously agreed to, and the meeting closed with votes of thanks to the Agent and staff in India on behalf of the shareholders and to the Chairman and Directors.

QUESTIONS IN PARLIAMENT

Fares Printed on Tickets

Mr. Magnay, on July 17, asked the Minister of Transport whether he was aware that it was not the practice of the railway companies to print the fares on summer return tickets; and what action he proposed to take in the matter.

Mr. Hore-Belisha.—I have already been in communication with the railway companies on this point and I am glad to say that they have agreed that, as and when monthly return tickets are reprinted, the fares will be indicated.

Palestine Railways Finance

Sir Wilfrid Sugden, on July 17, asked the Secretary of State for the Colonies if he could state what was the amount of profit or loss on the operation of the Palestine railways for the past financial year; and whether he was satisfied that they have been adequately adapted and improved to meet the developments which had taken place in that mandated territory during the past decade.

Mr. M. MacDonald.—In the financial year 1934-35 the lines comprising the Palestine railway system showed a net deficit of £87,940. Until a few years ago the financial position of Palestine restricted expenditure on the maintenance and improvement of the railways, but additional revenue is now available and considerable sums have already been spent and are about to be spent for this purpose.

Reports on Palestine Railways

In reply to questions as to the report of Sir Felix Pole on Palestine railway development, Mr. Malcolm MacDonald, Secretary of State for the Colonies, said, on July 17:—Sir Felix Pole gave a draft copy of his report to the High Commissioner before he left Palestine early in February, and copies of the report in its final form were sent to Palestine on May 30. Copies were received in the Colonial Office on April 3. I should explain that arising out of a report of a local committee on road and rail transport, three experts were invited to examine and report on three different aspects of railway communication in Palestine. Sir Felix Pole was asked to advise on certain specific proposals for improving the lay-out of the railway line (including station accommodation) in order to facilitate communication between Jaffa, Tel-Aviv, and Haifa, comprising a scheme for the deviation of the main line. Mr. Jenkin-Jones, of the L.N.E.R., was asked to advise upon development of traffic facilities, traffic organisation and rates, and Sir Laurence Halsey, of Messrs. Price, Waterhouse & Co., on the accounting system and the establishment of an adequate renewals fund. The recommendations of each of these experts contemplate expenditure of large sums. It will only be possible to reach final conclusions after a close study of all three reports which, particularly in their financial effect, are closely interrelated. They are now under consideration by the High Commissioner, who informs me that he hopes shortly to submit his considered views and recommendations. When these have been received and duly considered in the Colonial Office the question of publication of all or any of these reports will be decided.

Valuation of Railways in Scotland

Major Sir Archibald Sinclair on July 23 asked the Secretary of State for Scotland whether his attention had been drawn to recent decisions of certain assessment authorities reducing very materially, and in one case to zero, the net annual value of certain railway companies' hereditaments; whether he had considered the effect of these decisions on the finances of Scottish county and burgh councils.

Sir Godfrey Collins.—The answer to the first part of the question is in the affirmative. The valuation of Scottish railways has been fixed, subject to minor adjustments, for the years 1933 to 1938, and will not be affected by the decisions referred to during that period. I understand that appeals against these decisions, in one case to the House of Lords, are pending, and until these appeals have been determined consideration of the situation in Scotland after May 15, 1938, would be premature.

Eritrea Railway

Brigadier-General Nation, on July 24, asked the Secretary of State for Foreign Affairs how far the western terminus of the railway in Eritrea was from the Sudan and Abyssinian boundaries.

Sir Samuel Hoare.—I am advised that the western terminus of the Eritrea railway is probably situated at Biskia, approximately 60 miles east of the Sudan frontier and roughly the same distance north of the Abyssinian frontier. As it is possible that further construction is, however, taking place, I cannot guarantee the accuracy of the foregoing.

Road Licences to Railway Companies

Mr. Glossop, on July 24, asked the Minister of Transport if he would state why details of the number of licences granted to railway companies, under the Road and Rail Traffic Act, 1933, were not kept, in view of the fact that similar information was available of licences granted to road hauliers.

Mr. Hore-Belisha.—The answer to the first part of the question is that the licensing authorities have been charged by Parliament with the duty of relating the number of goods vehicles on the roads to the requirements of the public, and no analysis is made or required of the ownership of the vehicles. The answer to the second part of the question is that the figures which I gave my hon. friend on July 17 did in fact include licences granted to railway companies, and the number of vehicles operated under those licences.

XUM

NOTES AND NEWS

Welsh Highland Railway.—Passenger traffic for the summer tourist season was resumed on the Welsh Highland Railway on July 8.

Another G.W.R. Halt.—A new halt at Trehowell, between Weston-Rhyn and Chirk, is to be opened by the G.W.R. on Saturday next, July 27. Most of the local week-day stopping trains will call at the new halt, and cheap bookings will be given to Oswestry and Wrexham.

New Wing at Woking Orphanage.—A new wing at the Southern Railway Servants' Orphanage, Woking, Surrey, to accommodate 100 children, was opened on July 20 by Mrs. Robert Holland Martin, wife of the Chairman of the Southern Railway.

Ardoch Burn Bridge (L.M.S.R.) Restored.—Restoration of the bridge at Ardoch Burn (Perthshire), on the Callender line of L.M.S.R., which was washed away by a rainstorm on June 24, was completed, and the structure brought into use, on Monday last.

Special Saturday Service to Belgian Coast.—In order to deal with heavy week-end traffic, the Southern Railway has arranged a special early service to Belgium on Saturdays, leaving Victoria at 8.0 a.m. It arrives at Ostend at 1.25 p.m. and at Brussels at 4.35 p.m.

Through the French Alps by Railcar.—A railcar now runs through the Dauphiny and Maritime Alps of France from Grenoble to Nice and *vice versa*, via Digne and Puget Theniers. It leaves Grenoble at 7.30 a.m., arriving at Nice at 5.32 p.m., and in the reverse direction the departure from Nice is at 8 a.m., with the arrival at Grenoble timed for 5.5 p.m. This provides a comfortable and convenient method of seeing some of the most picturesque mountain scenery in France. The fares charged correspond to the third class railway fare plus a small supplement.

New Alpine Tunnel Projected.—It is reported from Vienna that Austrian and Italian railway authorities have under consideration an important project for improving railway communication between central and southern Europe. The main engineering work involved would be a new tunnel about 12 miles in length through the Alps under the famous Drei Zinnen Massive. The northern portal would be situated approximately 3,000 ft. above sea level near Mayrhofen in the Austrian Tyrol, and the southern portal on Italian soil near Bruneck in the Puster valley. It would thus pass through the mountains more than 20 miles eastward of the Brenner Pass but some 55 to 60 miles westward of the Tauern tunnel. The report adds that the proposed tunnel would facilitate shortening the present route from Berlin to Milan by nearly 100 miles, but details of the intended approach lines are not available at the moment.

Suspension of K.L.M. Liverpool-Hull Air Service.—The K.L.M. (Royal Dutch Air Lines) announces the suspension of its Amsterdam-Hull-Liverpool service as from yesterday, July 25.

London-Edinburgh Air Service Withdrawal.—The London-Leeds-Bradford - Newcastle-on-Tyne - Edinburgh air service, operated by North Eastern Airways Limited, is being withdrawn as from to-day, July 26.

New Internal Air Services.—It is reported that Crilly Airways Limited is to inaugurate early next month a new service which will place Norwich, Leicester, and Nottingham in direct communication with Liverpool, Blackpool, Belfast, and the Isle of Man.

Another London Transport Acquisition.—On July 24 the London Passenger Transport Board was granted licences in respect of bus services acquired by voluntary agreement from the Penn Bus Co. Ltd. The routes of that company outside the London area are in course of transfer to the Thames Valley Traction Co. Ltd., a G.W.R. and S.R. associate.

London Transport Bills.—The London Passenger Transport Board (Finance) Bill, which has been through the House of Commons, was read a second time in the House of Lords on July 23, and committed to the Committee on Unopposed Bills which met on July 24. The London Passenger Transport Board Bill was, on July 23, read a third time, with the amendments, in the Lords, and passed, and returned to the Commons.

Buenos Ayres & Pacific Moratorium.—Mr. Justice Eve has sanctioned a scheme of arrangement whereby the moratorium in respect of interest payments on certain debenture stocks of the Buenos Ayres & Pacific and Argentine Great Western Railway Companies which had been extended until June 30, 1935, under a scheme of 1932, may be further extended to June 30, 1936, with power to the stockholders' committee to make yet a further extension, if desired, to June 30, 1938.

G.S.R. (Ireland) Experience with Drumm Batteries.—Some interesting information concerning the development of the Drumm battery was given by Mr. Lemass, the Free State Minister for Industry and Commerce, in reply to a question in the Free State Legislature. Two-coach trains, each seating 140 passengers, have been operating successfully and economically on the Dublin-Bray section of the the Great Southern Railway, and have covered, since February and August, 1932, respectively, a mileage of approximately 156,000. Expert examination of cells which have been in service on the railway under the most arduous conditions justifies the directors, the Minister says, in guaranteeing ten years' life in traction service. The question of the extension of battery traction is at present under discussion with the railway company. Several road vehicles have been equipped with the battery and have covered a total mileage to date of approximately 24,000.

American Track Recorder.—Besides its speciality of the detector car, the Sperry Company developed not long ago a gyroscopic track recorder (described in *The Railway Engineer* of February, 1934). A new portable form of gyro-track recorder has lately been developed in the U.S.A. and has been used in the Burlington Zephyr streamlined diesel-electric train to check its running at high speed.

Institute of Metals Conference.—The annual conference of the Institute of Metals will be held at Newcastle-upon-Tyne from September 9 to September 12, under the chairmanship of the President, Dr. Harold Moore, C.B.E. The programme includes a civic welcome by the Lord Mayor of Newcastle on September 10, social functions, technical visits, and excursions, as well as the reading of papers and discussions thereon.

Southern Railway Rating Appeal.—The House of Lords has agreed to the petition of the Southern Railway that one printed case may be lodged applicable to the appeals lodged by the Railway Assessment Authority and the London County Council and others in regard to the Southern Railway valuation for rating case. Great importance attaches to the House of Lords decision in this case, because it will form the precedent upon which the valuations of the other railway companies will be based. Meanwhile, the proceedings in regard to the other companies are being held up. The total amount involved in the valuations is in excess of £13,000,000.

Long Engine Working, L.M.S.R.—With the inauguration of a locomotive schedule which calls for a return trip from London to Aberdeen and back (539¾ miles each way) the L.M.S.R. has established a new record for the longest through engine working in Britain. Previously this record was held by the through journey from London to Glasgow and back, 401½ miles each way, of the "Princess Royal" class 4-6-2 engines working the Royal Scot express. The locomotive concerned in the new London–Aberdeen schedule is of the "Royal Scot" 4-6-0 type and leaves Euston at 7.30 p.m. with the Royal Highlander express. It reaches Carlisle at 1.38 a.m. and refuels before proceeding at 5.16 a.m. with another express to Aberdeen. On arrival at Aberdeen the engine has 2½ hours before returning to Carlisle with the 1.55 p.m. express fish train. At Carlisle the engine again takes on a fresh supply of coal, continuing to London with the 1.7 a.m. sleeping-car

express from Carlisle, arriving at Euston at 7.25 a.m.—almost exactly 36 hours after leaving the metropolis, during which period it has covered 1,079½ miles.

Road Accidents.—The Ministry of Transport return for the week ended July 20, 1935, of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year :—

	Killed, including deaths resulting from previous accidents	Injured
England ...	... 117 (115)	4,572 (4,575)
Wales ...	... 2 (11)	211 (228)
Scotland ...	... 4 (18)	430 (465)
	123 (144)	5,213 (5,268)

The total fatalities for the previous week were 127, as compared with 143 for the corresponding period of last year.

Vickers-Armstrongs Shares.—The board of Vickers Limited announces that negotiations have been completed for the acquisition of 2,657,612 ordinary shares, 400 "A" preference shares, and 2,000,000 "B" preference shares in Vickers-Armstrongs Limited, from Armstrong Whitworth Securities Company, the A.W. Second Stock Trust, and A.W. Consolidated Stock Trust. Vickers Limited now holds the entire share capital of Vickers-Armstrongs Limited, which totals £17,464,251.

Glyn Valley Tramway.—This narrow-gauge line, which extends from the G.W.R. at Chirk to Glyn Ceiriog, was closed for all traffic on Saturday, July 6. It was originally incorporated in 1870 as the Ellesmere and Glyn Valley Railway, and opened in 1873 as a horse tramroad. The name was subsequently changed to the Glyn Valley Tramway. For over 45 years this 8¾ miles of 2 ft. 4½ in. gauge line has been worked by locomotives, and both passenger and goods traffic were conveyed until April 6, 1933, when the passenger service was withdrawn. We made editorial reference to this railway in our issue of September 21, 1934, and also illustrated one of its locomotives.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 29th Week			Totals to Date		
	1935	1934	Inc. or Dec.	1935	1934	Inc. or Dec.
	£	£	£	£	£	£
L.M.S.R. (6,925¼ mls.)						
Passenger-train traffic...	617,000	606,000	+ 11,000	13,232,000	12,908,000	+ 324,000
Merchandise, &c. ...	427,000	420,000	+ 7,000	12,916,000	12,864,000	+ 52,000
Coal and coke ...	168,000	172,000	— 4,000	6,668,000	6,659,000	+ 9,000
Goods-train traffic ...	595,000	592,000	+ 3,000	19,584,000	19,523,000	+ 61,000
Total receipts	1,212,000	1,198,000	+ 14,000	32,816,000	32,431,000	+ 385,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	416,000	407,000	+ 9,000	8,592,000	8,368,000	+ 224,000
Merchandise, &c. ...	305,000	285,000	+ 20,000	8,901,000	8,931,000	— 30,000
Coal and coke ...	182,000	196,000	— 14,000	6,444,000	6,601,000	— 157,000
Goods-train traffic ...	487,000	481,000	+ 6,000	15,345,000	15,532,000	— 187,000
Total receipts	903,000	888,000	+ 15,000	23,937,000	23,900,000	+ 37,000
G.W.R. (3,749¼ mls.)						
Passenger-train traffic...	262,000	262,000	—	5,466,000	5,392,000	+ 74,000
Merchandise, &c. ...	185,000	179,000	+ 6,000	5,231,000	5,173,000	+ 58,000
Coal and coke ...	90,000	92,000	— 2,000	2,856,000	2,875,000	— 19,000
Goods-train traffic ...	275,000	271,000	+ 4,000	8,087,000	8,048,000	+ 39,000
Total receipts	537,000	533,000	+ 4,000	13,553,000	13,440,000	+ 113,000
S.R. (2,171 mls.)						
Passenger-train traffic...	373,000	349,000	+ 24,000	8,151,000	7,953,000	+ 198,000
Merchandise, &c. ...	63,000	65,000	— 2,000	1,746,500	1,850,000	— 103,500
Coal and coke ...	26,000	26,000	—	863,500	902,000	— 38,500
Goods-train traffic ...	89,000	91,000	— 2,000	2,610,000	2,752,000	— 142,000
Total receipts	462,000	440,000	+ 22,000	10,761,000	10,705,000	+ 56,000
Liverpool Overhead ... (6½ mls.)	1,210	1,269	— 59	33,487	32,477	+ 1,010
Mersey (4½ mls.) ...	3,760	4,007	— 247	116,549	119,957	— 3,408
*London Passenger Transport Board ...	545,000	533,500	+ 11,500	1,664,700	1,633,900	+ 30,800
IRELAND						
Belfast & C.D. pass. (80 mls.)	6,320	4,866	+ 1,454	70,120	69,446	+ 674
,, ,, goods	410	473	— 63	14,427	15,128	— 701
,, ,, total	6,730	5,339	+ 1,391	84,547	84,574	— 27
Great Northern pass. (543 mls.)	17,150	15,750	+ 1,400	284,550	266,200	+ 18,350
,, ,, goods	7,500	7,150	+ 350	262,000	249,850	+ 12,150
,, ,, total	24,650	22,900	+ 1,750	546,550	516,050	+ 30,500
Great Southern pass. (2,124 mls.)	32,200	31,712	+ 488	654,346	649,617	+ 4,729
,, ,, goods	32,522	30,875	+ 1,647	989,633	926,651	+ 62,982
,, ,, total	64,722	62,587	+ 2,135	1,643,979	1,576,268	+ 67,711

* 3rd week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period of last year ; last year's figures are, however, adjusted for comparative purposes

British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices July 24, 1935	Rise/ Fall
G.W.R.				
Cons. Ord. ...	66½	48½	51	—
5% Con. Prefce. ...	118	109	123½	—
5% Red. Pref. (1950)	115	107	113½	—
4% Deb.	117	105	115½	—
4½% Deb.... ...	119	109	115½	—
4½% Deb.... ...	129½	115¼	127½	—
5% Deb.	135	126¼	138½	—
2½% Deb.... ...	75	64	78	—
5% Rt. Charge ...	134 7/16	123¼	136½	+1
5% Cons. Guar. ...	132¾	121¾	135½	—
L.M.S.R.				
Ord.	30½	19½	21½	−½
4% Prefce. (1923)	64¼	41	56½	−½
4% Prefce. ...	87	69½	84½	—
5% Red. Pref. (1955)	107	92½	104½	+1
4% Deb.	114⅛	100½	107½	—
5% Red. Deb. (1952)	118 11/16	111¼	115½	—
4% Guar.... ...	106½	96¾	104	—
L.N.E.R.				
5% Pref. Ord. ...	24¾	13½	11¾	−¼
Def. Ord.	11½	6⅞	5⅞	−⅛
4% First Prefce. ...	76	59½	64	−1
4% Second Prefce.	47	25½	24½	−½
5% Red. Pref. (1955)	94½	80	84½	—
4% First Guar. ...	104	92	101	—
4% Second Guar.	97⅞	86½	95	—
3% Deb.	90	74½	81½	—
4% Deb.	114	99¼	106	—
5% Red. Deb. (1947)	117	108	113½	—
4½% Sinking Fund Red. Deb.	111¼	105¼	110	—
SOUTHERN				
Pref. Ord.... ...	90	63⅛	84	—
Def. Ord.	32⅝	19	22½	−½
5% Prefce. ...	118 3/16	107½	123½	+½
5% Red. Pref. (1964)	115¾	107½	116½	—
5% Guar. Prefce.	132	120¾	135½	—
5% Red. Guar. Pref. (1957)	119½	113	119½	—
4% Deb.	116½	103¼	114	—
5% Deb.	134	124 15/16	135½	—
4% Red. Deb. 1962–67	113 11/16	105 9/16	113½	—
BELFAST & C.D.				
Ord.	6	5	4	—
FORTH BRIDGE				
4% Deb.	110	100	108½	—
4% Guar.	110	100	107½	—
G. NORTHERN (IRELAND)				
Ord.	9¾	4 15/16	14¾	—
G. SOUTHERN (IRELAND)				
Ord.	25	12½	30	—
Prefce.	21½	13 15/16	43	—
Guar.	48	39	76	+1
Deb.	67	59	79	−1
L.P.T.B.				
4½% "A" ...	126	115	124½	—
5% "A"	135½	124½	134½	—
4½% "T.F.A." ...	113½	107½	111	—
5% "B"	131¾	118	127½	—
"C"	97	73	98	—
MERSEY				
Ord.	15¼	7	12	—
4% Perp. Deb. ...	93½	82½	94½	—
3% Perp. Deb. ...	66½	61½	70½	—
3% Perp. Prefce....	54	44½	52½	—

* ex-dividend

CONTRACTS AND TENDERS

Jessop & Co. Ltd. has received an order from the South Indian Railway Administration for seven broad-gauge steel four-wheeled goods brake vans without wheels and axles.

Cowans, Sheldon & Co. Ltd. has received an order from the London & North Eastern Railway for one 35-ton breakdown crane designed to lift 35 tons at 25 ft. radius and lesser loads at greater radii, and fitted with Cowans, Sheldon's patent system of relieving bogies to reduce axle loading when the crane is in running order. The crane incorporates all the latest practice, including a turbo-driven electric flood-lighting outfit for night working.

Reichsbahn Rolling Stock Programme

The German State Railway rolling stock programme for the first half of 1936, agreed upon by the board of directors at a recent meeting at Saarbrücken, covers the purchase of 2,200 vehicles of every kind, 86 steam locomotives for express and local services, 27 electric locomotives for the now more extensive electrified system, and 48 smaller engines for shunting. Of 53 motor coaches and corresponding passenger coaches to be ordered for electric lines, 48 are intended for the Berlin Stadtbahn. For the further development of railcar services, 106 railcars and trailers will be purchased. The stock of passenger coaches is to be increased by 268 D-train coaches and 142 other passenger coaches; 849 new goods vehicles of different kinds are to be bought. In addition, 60 luggage vans for D trains and nine service cars will be ordered. Various material is also being ordered for the State Railway's road motor services.

The Egyptian State Railways Administration has placed the following orders :—

Head Wrightson & Co. Ltd.: screw couplings. (Ref. E.S.R. 21,331, total price £495, f.o.b. Middlesbrough.)

Robert Stephenson & Co. Ltd.: Wheels. (Ref. E.S.R. 21,338, total price £330, f.o.b. Middlesbrough.)

W. F. Dennis & Co. Ltd.: Wire. (Order No. 574, total price £411 5s. f.o.b. Antwerp.)

British Insulated Cables Limited: Cable. (Ref. E.S.R. 30,170, total price £288 17s. 9d. f.o.b. English port.)

S. A. Usines et Boulonneries de Mariemont: Bolts and nuts. (Ref. E.S.R. 3,165, items 2 to 5, total price £545 8s. 9d. f.o.b. Antwerp.)

Stewarts and Lloyds Limited: Tubes. (Ref. E.S.R. 17,110, total price £209, f.o.b. Glasgow.)

English Steel Corporation Limited: Helical buffing springs. (Ref. E.S.R. 21,324, total price £973 15s. f.o.b. London or Liverpool.)

P. & W. MacLellan Limited: 50 met. tons tin ingots. (Ref. E.S.R. 306 G3/1, total price £11,085 8s. f.o.b. Liverpool based on settlement price of tin of £225 per ton.)

Geo. H. Sheffield & Co. (Engineers) Ltd. has received orders for the supply of Sheffield-Twinberrow bogies for the two all-steel saloon coaches which, as announced in this column in our issue of last week, have been ordered by the Crown Agents for the Colonies from the Metropolitan-Cammell Carriage & Wagon Co. Ltd. for service on the 3 ft. 6 in.-gauge lines of the Gold Coast Government Railway.

The Vulcan Foundry Co. Ltd. has received orders from the Madras & Southern Mahratta Railway for a total of 21 broad-gauge locomotive boilers divided as follow :—four AS 4-6-0 passenger, six DS 2-8-0 goods, nine VS 0-6-0 goods, one XB 4-6-2 passenger and one XD 2-8-2 goods locomotives.

Russia Buys Railway Material from Hungary

The Russian Soviet Government has placed an order in Hungary for 10,000 railway locomotive and wagon wheels, says Reuters Trade Service, quoting Continental papers. This order will not come under the commercial agreement between the two countries and will be paid for within a short period. In 1934 Hungary exported a total of 16,500 double-hundredweight of railway wheels to Holland, Jugoslavia, Roumania, Egypt, and British India, but has sent none to the U.S.S.R. since 1928.

Estonian Rail Order for Russia

The Estonian Railways Administration has recently bought 1,500 tons of rails from the U.S.S.R. instead of getting them from western European countries as in the past, says Reuters Trade Service from Tallinn. The purchase is a sequel to satisfactory exports to Russia of cattle for breeding and slaughter.

The United Steel Cos. (India) Ltd. has received orders from the Indian Stores Department for approx. 47,000 steel sleepers and bolts, nuts, clips and washers.

The Bombay, Baroda & Central India Railway Administration has placed the following orders, to the inspection of Messrs. Rendel, Palmer & Tritton: J. O'Hara Murray & Co. Ltd.: 451 locomotive tyres; and Premier Steel Tube Co. Ltd.: 3,031 steel boiler tubes and 100 flue tubes.

New Railway Wagon Works for Turkey

To meet the requirements of the Turkish State Railways, the Turkish Government intends setting up a factory, learns Reuters Trade Service, for the construction of railway wagons at Adabasar (North Anatolia).

British Timken Limited has received a repeat order for 112 tapered bearings for the Queensland Government Railways, this following an initial order for 264 axleboxes. An order for Timken bearings recorded in our issue last week was inadvertently referred to as being secured by the Timken Roller Bearing Co. Ltd. This order should have been attributed to British Timken Limited, and the bearings and axleboxes concerned will therefore be of entirely British manufacture.

It is reported that negotiations are under way in Mukden, between officials of the Peiping-Mukden Railway Bureau and representatives of Manchukuo, for the acquisition, by the former, of two new trains of ten coaches each.

The Sorocabana Railway Administration is inviting tenders receivable by August 28 for steel tyres for locomotives, tenders, carriages and wagons.

The tenders invited by the Sorocabana Railway Administration for nine metre-gauge 0-8-0 shunting locomotives, or alternative direct-mechanical or diesel-electric locomotives, as announced in THE RAILWAY GAZETTE for July 12, 1935, in this column, are now receivable by August 26, an extension of 20 days on the original tender date.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, invites tenders receivable by August 20 for the following machine tools :—One 15-in. centre and one 8½-in. centre lathe; one horizontal 60-in., and one vertical 30-in. milling machine; one 10-in. turret combination and one 7-in. capstan lathe; two plain cup wheel wet tool grinders with 16-in. diam. grinding wheels, one 32-in. spur and spiral gear planing machine; one automatic saw blade sharpening machine, and three 6-ft. portable universal radial drilling and tapping machines. I.S.D. standard specification No. C-29B will apply.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, invites tenders receivable by August 29 for copper armoured cable for 660 volts required for railway signalling equipment.

The Egyptian State Railways Administration invites tenders receivable by September 3 at the office of the Superintendent of Stores, Saptieh, Cairo, for the supply of one petrol-electric mobile 6-ton railway crane.

Karrier Motors Successors Limited, Sales Department, in charge of Mr. H. W. Hattersley, has now been transferred from Huddersfield to Luton. All sales, publicity and advertising communications should in future be addressed to Karrier Motors Successors Limited, Biscot Road, Luton, Bedfordshire. Telephone: Luton 2360.

Large Wagon Tippler for China

The Fraser & Chalmers Engineering Works of the General Electric Co. Ltd. has just completed what is believed to be the longest wagon tippler so far constructed in this country. It is to be shipped to the new port of Lunghai on the Chinese National Railways, for which the Fraser & Chalmers Engineering Works recently secured an extensive contract covering a complete power station and handling equipment. The tippler was demonstrated yesterday to a party of engineers and other visitors at Erith. It is of the Fraser & Chalmers side-discharge type designed for handling Belgian wagons of from 10 to 40 tons weight and up to 45 ft. in length.

The Armstrong Oiler Co. Ltd., of York, has appointed Meboe (India) Limited, of Calcutta and Bombay, to act as agent for the sale of the former company's specialities in India and Burma.

OFFICIAL NOTICES

South Indian Railway Company Limited.

THE Directors are prepared to receive tenders for the supply of :—
(1) Solid Drawn Steel Boiler Tubes,
(2) Volute Springs,
(3) Steel Bars, Sections and Galvanised Sheets.

Specifications and Forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Steel Boiler Tubes," or, as the case may be, with the name of the firm tendering, must be left with the undersigned not later than 12 noon on Friday, the 9th August, 1935.

The Directors do not bind themselves to accept the lowest or any tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specification No. 1 and of 5s. for each copy of Specifications Nos. 2 and 3.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White & Partners, 3, Victoria Street, S.W.1.

E. A. S. BELL,
Managing Director.

91, Petty France,
Westminster, S.W.1.
24th July, 1935.

WANTED for large European firm of Engineers in India, a Senior Estimator and Designer in the Bridge and Structural Department. Applicants should be of good address and education, and possess practical workshop experience and sound knowledge of design of steel bridges and structures. Preference will be given to those holding B.Sc. (London) or equivalent degrees. Age between 25 and 30. First agreement will be for a period of five years. Applications by letter, with copies of references and details of experience, stating age and whether married or single, to "E. & D.," c/o W. Abbott Limited, 32, Eastcheap, London, E.C.3.

THE Proprietors of the Patent No. 382698 for "Improvements in or relating to Rail Seatings" are desirous of entering into arrangements by way of license and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to HASELTINE LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

OFFICIAL ADVERTISEMENTS

OFFICIAL ADVERTISEMENTS intended for insertion on this page should be sent in as early in the week as possible. The latest time for receiving official advertisements for this page for the current week's issue is noon on Thursday. All advertisements should be addressed to :—*The Railway Gazette*, 33, Tothill Street, Westminster, London, S.W.1.

RAILWAY AND OTHER REPORTS

Southern Railway Company.—The Secretary writes, July 25 : "The directors announce that for the half-year ended June 30 last, the receipts from passenger train traffic have increased by £135,000, as compared with the corresponding period of last year, and the goods train traffic shows a decrease of £165,000. Railway expenditure has increased by £45,000, due to increased payments for salaries and wages as a result of the partial restoration of the percentage deductions. The net receipts from steamboats, docks, harbours and wharves, hotels, interest, &c., remain about the same. The net revenue for the half-year is approximately £75,000 less. Although the directors have no reason to think that the results for the whole year 1935 will be better than those of 1934, they have decided, in fairness to the large number of holders of preferred ordinary stock, to pay an interim dividend of £1 per cent. on the preferred ordinary stock. Last year no interim dividend was paid on this stock. Interim dividends of £2 10s. per cent. on the guaranteed preference and preference stocks, together with the interim dividend of £1 per cent. on the preferred ordinary stock, will be paid (less income tax) on August 15 next. Warrants will be posted on August 14."

London Midland & Scottish Railway.—The Secretary writes, July 25 : "For the first half of 1935, compared with that of the previous year, the net revenue of the company is unchanged, namely :—

	Railway £	Other business interest, &c. £	Total £
Additional receipts.. ..	200,000	—	200,000
Additional expenditure—			
Salaries and wages ..	170,000	30,000	200,000
Other.. ..	— *70,000*	70,000	—
	100,000	100,000	200,000
Net ..	+ 100,000	— *100,000*	—

"The traffic receipts for the 26 weeks from December 31 to June 30 increased by £300,000, and the difference between this and the increase of £200,000 for the half-year from January 1 to June 30 is due to the 1935 half-year including one less weekday than that for 1934. This will be balanced in the half-year ending December, 1935, as this period will include an additional weekday. The traffic receipts, which for freight train traffic were disappointing in the earlier part of the year, improved by £358,000 in the last 12 weeks and at the end of the 29th week were £385,000 greater than in 1934, each class of traffic receipts showing an increase. In the circumstances, the directors have decided to make interim payments on the 4 per cent. preference stock at the rate of £2 per cent. ; and on the 5 per cent. redeemable preference stock (1955) at the rate of £2 10s. per cent. ; and no interim payment on the 4 per cent. preference stock (1923) and ordinary stock. The warrants in payment of these dividends will be posted on August 20."

Great Northern Railway (Ireland).—The Secretary writes, July 24 :—"After transferring a sum from reserves, the directors have declared, subject to audit, an interim dividend of £2 per cent. (less income tax) on the consolidated four per cent. guaranteed stock for the half-year ended 30th ultimo, which will be paid on September 2 next. The results for the half-year ended June 30, 1935, do not permit of the payment of any interim dividends on the preference and ordinary stocks."

Gloucester Railway Carriage & Wagon Co. Ltd.—A net profit is shown for the year ended May 31, 1935, of £1,635, following net losses of £46,986 for 1933-34 and £50,864 for 1932-33. The profit is added to the balance forward, making it £5,197. The directors report that the latter part of the year witnessed a steady revival in the building of railway rolling-stock at the works, and that the prospects of this side of the business are considerably brighter than they have been for several years past. The improvement in the wagon-hiring business has been well maintained, with the result that all the company's simple hire wagons were let on hire at the close of the year. The subsidiary the Gloucester Foundry, Limited, has continued to make satisfactory profits, and the demand for its products is steadily increasing. In order to make these profits available for future dividends a reconstruction scheme has been prepared and has received the sanction of the Court.

Royal Station Hotel, Hull

Modernisation of the L.N.E.R. Royal Station Hotel at Hull has now been completed. The work, which has amounted practically to the complete rebuilding of the structure, was begun in 1931 and has been carried out in three consecutive stages so that guests should suffer the least inconvenience during the time the works were in progress. Not only has the hotel been enlarged, but it has been completely redecorated and some 27 additional bathrooms have been installed. The most striking feature of the reconstructed hotel is the new dining room, some 60 ft. square, panelled in Australian walnut, which is very appropriate having regard to the port of Hull's connection with the Commonwealth. The structure of this room involved the use of a steel girder, 58 ft. long, weighing 10 tons, which contains no rivets, but is welded throughout. There is also a suite comprising a reception and dining room for 40 persons with dressing room accommodation suitable for small functions. Over the mantelpiece are two paintings illustrating the gift of a State sword to King Charles I in 1639, and Sir Charles Hotham refusing the same king entrance to the city in 1642. The new cocktail bar is appropriately decorated to suggest the head of an old stone pier, above which has been painted a very fine panorama of the River Humber.

XUM

Railway Share Market

The stock and share markets have entered upon a three week account to the accompaniment of the holiday attractions and the inertia induced by the warm weather. Hence, no striking changes in quotations in home railway stocks were expected notwithstanding the issue this week of the half-yearly statements of the four railway groups.

Stock Exchange dealers were confidently counting on a decision by the London Midland & Scottish directors to pay the full half-year's dividend on the 5 per cent. redeemable preference stock as it would mean that the corresponding payment for the half-year would be made on the 4 per cent. first preference stock which ranks *pari passu* with the redeemable stock Speculative interest goes beyond that because the 1923 preference stock is brought within sight of a substantial dividend when the full dividends on the two senior preference stocks are assured. Last year full payments were made on the stocks whilst the 4 per cent. 1923 preference received $1\frac{5}{8}$ per cent. As the total issue of the latter stock amounts to only £40 millions as against £127 millions of the two senior stocks the market attaches more speculative interest to a possible increase of net revenue sufficient to justify the distribution of the full 4 per cent. on the 1923 stock. The other stocks in which there is a great deal of Stock Exchange interest are the preferred ordinary and deferred ordinary stocks of the Southern. There was a fair volume of purchases of these stocks early this week in expectation of the company benefiting from traffic incidental to the Naval Review. Wednesday's traffic returns did not do much however, to stimulate the market as a whole, although the series of plus figures gave satisfaction and prices retained steadiness.

The market ignored the reports which had been current over the week-end about the acquisition by the railways of the R.M. interest in Coast Lines. The subsequent official denial was not unexpected. It is believed that unofficial suggestions have been made for the acquisition of the Coast Lines interest by an issuing house with a view to making a public issue with the financial support of the railways. At no time did the matter come under official negotiation. Foreign railway stocks were quiet and Argentine issues tended to go back. San Paulo and Leopoldina weakened with the Brazil Government bonds.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1934-35	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1934	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1934	Prices: Lowest 1934	Prices: July 24, 1935	Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	830	21.7.35	11,370	— 2,910	29	359,170	385,350	— 26,180	Ord. Stk.	$26\frac{3}{4}$	19	$20\frac{1}{2}$	Nil
	Argentine North Eastern ..	753	20.7.35	7,738	+ 50	3	23,024	23,056	— 32	„	11	$6\frac{7}{8}$	6	Nil
	Argentine Transandine ..	111	—	—	—	—	—	—	—	A. Deb.	52	45	$47\frac{1}{2}$	$8\frac{7}{16}$
	Bolivar	174	June, 1935	6,000	+ 900	26	39,400	38,750	+ 650	6 p.c. Deb.	10	$6\frac{1}{2}$	10	Nil
	Brazil	—	—	—	—	—	—	—	—	Bonds.	$13\frac{5}{4}$	$10\frac{7}{16}$	13	$3\frac{15}{16}$
	Buenos Ayres & Pacific ..	2,806	20.7.35	74,618	+ 1,927	3	217,138	214,165	+ 2,973	Ord. Stk.	$16\frac{1}{2}$	$8\frac{1}{2}$	8	Nil
	Buenos Ayres Central ..	190	30.6.35	$117,200	— $16,600	52	$5,776,800	$5,584,400	+ $192,400	Mt. Deb.	23	10	16	Nil
	Buenos Ayres Gt. Southern	5,085	20.7.35	113,984	— 17,571	3	329,147	361,995	— 32,848	Ord. Stk.	35	22	$22\frac{1}{2}$	Nil
	Buenos Ayres Western	1,930	20.7.35	34,665	— 8,708	3	115,709	131,983	— 16,274	„	$27\frac{1}{2}$	$18\frac{1}{2}$	18	Nil
	Central Argentine	3,700	20.7.35	129,838	— 8,114	3	367,380	384,738	— 17,358	„	23	$13\frac{1}{2}$	13	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	14	7	8	Nil
	Cent. Uruguay of M. Video	273	20.7.35	9,029	— 6,947	3	25,535	50,155	— 24,620	Ord. Stk.	$15\frac{1}{2}$	8	$4\frac{1}{2}$	Nil
	Do. Eastern Extn.	311	20.7.35	1,541	+ 152	3	4,393	4,178	+ 215	—	—	—	—	—
	Do. Northern Extn.	185	20.7.35	1,333	+ 537	3	3,414	2,597	+ 817	—	—	—	—	—
	Do. Western Extn.	211	20.7.35	614	+ 19	3	1,553	1,631	— 78	—	—	—	—	—
	Cordoba Central	1,218	20.7.35	33,670	— 3,160	3	103,670	107,740	— 4,070	Ord. Inc.	6	3	$2\frac{1}{2}$	Nil
	Costa Rica	188	May, 1935	13,867	— 2,792	48	176,238	197,823	— 21,585	Stk.	$30\frac{3}{4}$	$23\frac{1}{2}$	$31\frac{1}{2}$§	$6\frac{5}{8}$
	Dorada	70	June, 1935	11,800	+ 3,000	26	66,800	60,200	+ 6,600	1 Mt. Db.	103	95	$102\frac{1}{2}$	$5\frac{7}{8}$
	Entre Rios	810	20.7.35	11,304	+ 1,052	3	33,319	30,016	+ 3,303	Ord. Stk.	$21\frac{1}{2}$	12	10	Nil
	Great Western of Brazil	1,082	20.7.35	4,900	—	29	227,100	226,500	+ 600	Ord. Sh.	$7\frac{8}{8}$	$\frac{5}{8}$	$\frac{1}{2}$	Nil
	International of Cl. Amer.	794	May, 1935	$497,050	+ $21,927	21	$2,260,638	$2,466,672	— $206,034	—	—	—	—	—
	Interoceanic of Mexico ..	—	—	—	—	—	—	—	—	1st Pref.	1/-	1/-	$\frac{1}{2}$	Nil
	La Guaira & Caracas ..	$22\frac{5}{4}$	June, 1935	3,915	+ 35	26	23,845	21,435	+ 2,410	Stk.	$12\frac{5}{4}$	$7\frac{5}{8}$	$8\frac{1}{2}$	Nil
	Leopoldina	1,918	20.7.35	31,300	— 5,670	29	651,311	646,365	+ 4,946	Ord. Stk.	$14\frac{5}{8}$	7	4	Nil
	Mexican	483	14.7.35	$236,700	+ $16,800	2	$468,100	$436,800	+ $31,300	„	$3\frac{1}{4}$	$1\frac{1}{2}$	1	Nil
	Midland of Uruguay ..	319	June, 1935	5,800	— 2,399	52	109,846	111,908	— 2,062	„	$1\frac{1}{2}$	$\frac{1}{2}$	$1\frac{1}{8}$	Nil
	Nitrate	401	15.7.35	8,481	+ 4,591	28	80,994	80,588	+ 406	Ord. Sh.	32^{9}_{52}	51/-	$2\frac{3}{8}$	Nil
	Paraguay Central	274	20.7.35	$1,671,000	+ $608,000	3	$5,187,000	$2,885,000	+ $2,302,000	Pr. Li. Stk.	84	67	$73\frac{1}{2}$	$8\frac{5}{16}$
	Peruvian Corporation ..	1,059	June, 1935	66,756	+ 11,914	52	764,032	674,250	+ 89,782	Pref.	$14\frac{1}{2}$	8	8	Nil
	Salvador	100	13.7.35	¢14,950	+ ¢5,140	2	¢23,638	¢22,060	+ ¢1,578	Pr. Li. Db.	75	70	65	$7\frac{11}{16}$
	San Paulo	$153\frac{1}{2}$	14.7.35	22,245	— 6,210	28	712,911	782,760	— 69,849	Ord. Stk.	86	67	$45\frac{1}{2}$	$5\frac{1}{2}$
	Taltal	164	June, 1935	2,875	+ 657	52	36,940	27,268	+ 9,672	Ord. Sh.	$2\frac{1}{8}$	$1\frac{7}{16}$	$1\frac{1}{2}$	$6\frac{11}{16}$
	United of Havana	1,365	20.7.35	21,547	+ 3,845	3	57,666	50,705	+ 6,961	Ord. Stk.	6	2	$2\frac{1}{2}$	Nil
	Uruguay Northern	73	June, 1935	608	— 370	52	11,946	13,533	— 1,587	Deb. Stk.	$6\frac{1}{4}$	3	$4\frac{1}{2}$	Nil
Canada.	Canadian National	23,735	14.7.35	661,279	+ 4,696	28	17,304,253	17,161,471	+ 142,782	—	—	—	—	—
	Canadian Northern ..	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	$78\frac{1}{4}$	$51\frac{1}{2}$	$55\frac{1}{2}$	$7\frac{5}{16}$
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	$104\frac{1}{2}$	$97\frac{1}{4}$	$100\frac{1}{2}$	$3\frac{15}{16}$
	Canadian Pacific	17,211	14.7.35	485,600	— 400	28	12,279,000	12,396,600	— 117,600	Ord. Stk.	$18\frac{5}{16}$	$11\frac{1}{16}$	$10\frac{1}{2}$	Nil
India.†	Assam Bengal	1,329	20.6.35	35,685	— 1,952	11	262,485	322,804	— 60,319	Ord. Stk.	$88\frac{1}{2}$	72	$83\frac{1}{2}$	$3\frac{9}{16}$
	Barsi Light	202	30.6.35	2,970	— 877	13	33,765	41,062	— 7,297	Ord. Sh.	$104\frac{1}{2}$	$98\frac{3}{4}$	$90\frac{1}{2}$	$6\frac{1}{16}$
	Bengal & North Western ..	2,114	10.7.35	63,740	— 2,111	15	748,871	797,987	— 49,116	Ord. Stk.	$297\frac{1}{2}$	262	$295\frac{1}{2}$	$5\frac{7}{16}$
	Bengal Dooars & Extension	161	30.6.35	3,769	— 474	13	29,188	32,489	— 3,301	„	$125\frac{1}{4}$	124	$125\frac{1}{2}$	$5\frac{9}{16}$
	Bengal-Nagpur	3,268	20.6.35	168,900	+ 846	11	1,457,100	1,425,628	+ 31,474	„	$105\frac{1}{2}$	96	$102\frac{1}{2}$	$3\frac{7}{8}$
	Bombay, Baroda & Cl. India	3,072	10.7.35	203,475	— 16,725	15	2,367,000	2,365,275	+ 1,725	„	115	$108\frac{1}{2}$	$113\frac{1}{2}$	$5\frac{5}{16}$
	Madras & South'n Mahratta	3,230	30.6.35	149,775	— 9,141	13	1,431,976	1,603,832	— 171,856	„	131	$122\frac{3}{4}$	$121\frac{1}{2}$	$7\frac{15}{16}$
	Rohilkund & Kumaon ..	546	10.7.35	11,045	— 324	15	149,953	156,250	— 6,297	„	263	250	$287\frac{1}{2}$	$3\frac{9}{16}$
	South India	2,526	30.6.35	109,107	— 8,510	13	1,050,264	1,080,835	— 30,571	„	119	115	$117\frac{1}{2}$	$6\frac{15}{16}$
Various.	Beira-Umtali	204	May, 1935	70,053	+ 11,181	34	520,214	399,848	+ 120,366	—	—	—	—	—
	Bilbao River & Cantabrian	15	June, 1935	1,261	— 97	26	9,905	10,459	— 554	—	—	—	—	—
	Egyptian Delta	622	30.6.35	4,921	— 157	13	46,629	47,103	— 474	Prf. Sh.	$21\frac{5}{16}$	$15\frac{4}{4}$	$15\frac{4}{4}$	$5\frac{11}{16}$
	Great Southern of Spain ..	104	13.7.35	923	— 298	28	50,610	58,847	— 8,237	Inc. Deb.	4	$3\frac{1}{2}$	$3\frac{1}{2}$	Nil
	Kenya & Uganda	1,625	June, 1935	165,532	— 7,047	26	1,292,777	1,222,928	+ 69,849	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50	33	$41\frac{1}{2}$	$8\frac{7}{16}$
	Mashonaland	913	May, 1935	125,884	+ 19,026	34	945,921	731,020	+ 214,901	1 Mg. Db.	101	$91\frac{5}{4}$	103	$4\frac{7}{8}$
	Midland of W. Australia ..	277	May, 1935	13,048	+ 912	48	147,834	146,176	+ 1,658	Inc. Deb.	100	93	$94\frac{1}{2}$	$5\frac{5}{16}$
	Nigerian	1,905	8.6.35	20,542	— 4,995	10	263,607	271,103	— 7,496	—	—	—	—	—
	Rhodesia	1,538	May, 1935	198,403	+ 26,795	34	1,540,983	1 234,884	+ 306,099	4 p.c. Db.	$104\frac{7}{8}$	$97\frac{1}{2}$	104	$3\frac{15}{16}$
	South African	13,217	29.6.35	593,590	+ 81,679	13	6,969,945	6,297,277	+ 672 663	—	—	—	—	—
	Victorian	4,728	Feb., 1935	753,986	— 19,539	34	6,340.598	6,162,144	+ 178,454	—	—	—	—	—
	Zafra & Huelva	112	June, 1935	9,846	— 232	26	65,245	65,801	— 556	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of $\frac{1}{16}$

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the sterling weekly receipts at the par rate of exchange has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rate of exchange and not on the par value

Electric Railway Traction

Hungarian Electrification Results

FOR some little time past all the traffic on the main line between Budapest and Hegyeshalom of the Hungarian State Railways (except for a few local trains) has been electrically hauled, and the formal opening ceremony took place last Wednesday. In *The Railway Engineer* of October, 1933, there appeared full illustrated descriptions of the novel system of electrification devised by the late Dr. Kalman von Kando. Briefly the system consists of supplying the overhead line with single-phase current at industrial pressure and frequency, namely, 16,000 volts and 50 cycles, and incorporating in each locomotive a phase converter the functions of which are the reduction of the voltage and the provision of 3-phase current to the traction motors. Trials of this system began in 1922 on a short section of line out of Budapest, and in view of the satisfactory results it was decided to electrify the whole of the Budapest-Vienna main line within Hungarian territory. The original contracts were placed in April, 1931, supply and erection of the complete equipment for the four sub-stations being ordered from the Metropolitan-Vickers Electrical Co. Ltd., which company also acted as sub-contractor to Ganz of Budapest for the supply and manufacture of pantographs, control equipments, and 30 2,500 h.p. main traction motors, including four spares, for 26 locomotives. The first passenger locomotive began its trials on May 6, 1932, and after a period of intermittent service it entered into regular passenger service on September 12, 1932. Within twelve months this locomotive had run a total of 86,048 miles. The second locomotive and two freight locomotives followed in quick succession and gave such satisfactory results that a further 22 locomotives were put in hand in April, 1933, and completed in April of the present year. The freight locomotives were designed to haul heavy trains at reduced speeds, but after experience in service it was decided to standardise the passenger type, the freight trains being reduced in weight correspondingly. The total mileage covered by the 26 locomotives up to May 31, 1935, amounts to 1,300,000 miles, of which one of the passenger locomotives has accounted for no less than 205,500 miles. The monthly performance of the locomotives in service varies between 6,830 and 8,070 miles ranging from fast through expresses to slow freight trains stopping at every station. The locomotives have been uniformly reliable and it has been possible to put all of them into scheduled service almost immediately under the care of fresh and comparatively untrained personnel. This is the more creditable in that the phase changers and automatic regulators have worked perfectly without giving rise to any difficulties whatever despite the phase converter generally being regarded as the most complicated part of the locomotive. Not the slightest trouble has been given nor has any maintenance been necessary in any instance. It is also noteworthy, in view of the pronounced speed changes of the 3-phase motor, that any desired intermediate speed can be obtained without difficulty. For example, although the synchronous speed at the fourth stage is 100 km.p.h. (62·1 m.p.h.), the speed between Gyor and Hegyeshalom is limited to 85 km.p.h. (52·8 m.p.h.) by simple adjustment of the so-called acceleration lever, and remains practically unchanged of its own accord, only a few extra litres of water being evaporated in the starting resistance. The single-phase traction load has been distributed all over the 3-phases of the national power system, and even with the increased traffic the traction load does not disturb either the power system or the lighting and power consumers it serves. The sub-stations and overhead line had worked with the greatest reliability, so it may be said that the whole system from power station to locomotive has fully realised expectations.

Big London Electrification Scheme

ONE of the greatest fillips given in recent years to suburban railway electrification in the London area was the announcement at the beginning of June by the Chancellor of the Exchequer that Government credit was to be used to promote plans for electrification and improvement works estimated to cost £35 million. On July 10 a company entitled the London Electric Transport Finance Corporation Limited was incorporated, with a Bank of England directorate, to raise the money under Government guarantee, and to lend it to the railways concerned in the proportions of L.P.T.B. 70 per cent., L.N.E.R. 25 per cent., and G.W.R. 5 per cent. This company made a public issue of £32 million a few days later, which was fully subscribed. The electrification works projected, and many others in the London area, have been the subject of intensive study by the railway administrations concerned over a long period of years, but previous schemes have always been shelved by reason of the great difficulty encountered by protagonists of railway electrification in convincing the financial powers that in suitable circumstances electrification is a commercial proposition, capable of paying an adequate return on the expenditure involved. Two maps which we publish on page 172 indicate the extent of the railway schemes—for the full plans also involve the conversion of some 148 route miles of tramway to trolleybus operation. A notable feature is that the King's Cross to Finsbury Park line is not scheduled for electrification, so the Northern City Line of the L.P.T.B. is to take over the G.N.R. electric services at Finsbury Park and convey them to Moorgate. In fact, with the sole exception of the L.N.E.R. line from Liverpool Street to Shenfield, all the electrification works appear to be designed for the projection of tube rolling stock over main line suburban sections. Another noticeable feature is the inclusion of both eastward and westward extensions of Central London Line services so as to provide that balanced working (such as between Edgware and Morden) which London Transport has found by experience to provide the most suitable way of utilising rolling stock.

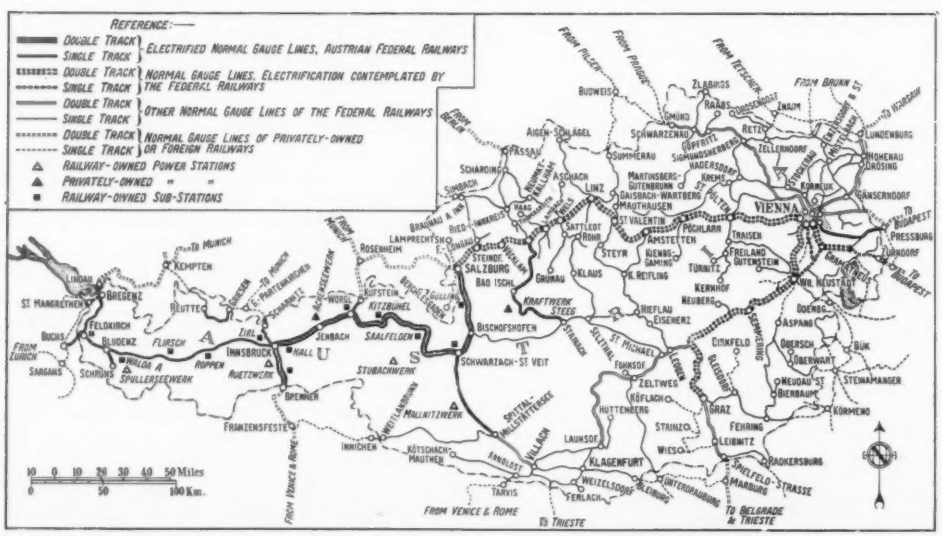
XUM

ELECTRIFICATION OF THE TAUERN SECTION OF THE AUSTRIAN FEDERAL RAILWAYS

By Ministerialrat Ing. ERNST R. KAAN, Director of Electrification of the Austrian Federal Railways

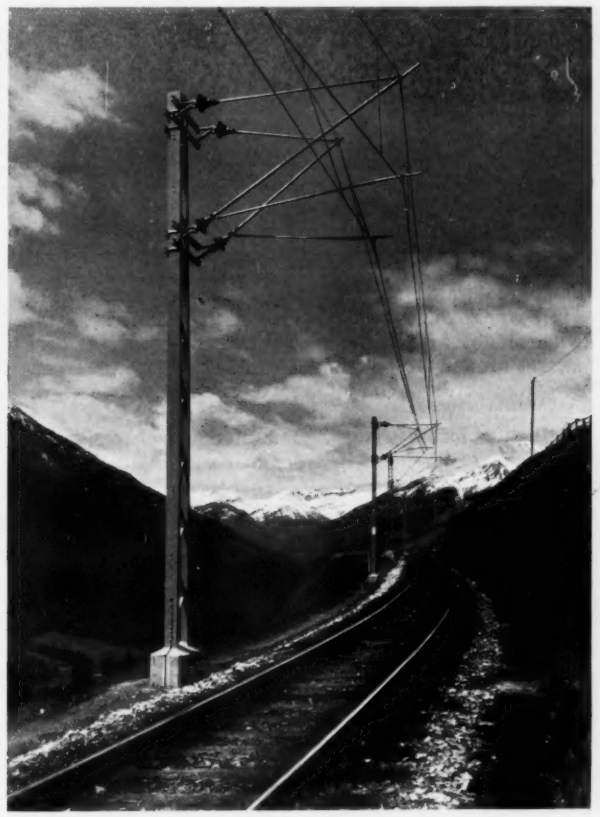
Goods train on the Tauern line hauled by a 1,400 h.p. electric locomotive with E-type wheel arrangement

THE inauguration of electrical operation on the southern section of the Tauernbahn on May 14, 1935, marks an important stage in the electrification of the Austrian Federal Railways. The Tauernbahn, following the line Schwarzach-St. Veit—Spittal-Millstättersee, is one of the most important railways in the Eastern Alps, serving north and south international traffic. The scenic beauties render the route specially attractive to tourists, and apart from the volume and importance of the traffic, the heavy gradients make the line particularly suitable for electrical operation. The northern section, including the 8,551-metre (28,055-ft.) crest tunnel through the main mass of the Tauern range, was equipped electrically during the years 1932 and 1933, and the southern section of the


REFERENCE:—
DOUBLE TRACK } ELECTRIFIED NORMAL GAUGE LINES, AUSTRIAN FEDERAL RAILWAYS
SINGLE TRACK }
DOUBLE TRACK } NORMAL GAUGE LINES, ELECTRIFICATION CONTEMPLATED BY
SINGLE TRACK } THE FEDERAL RAILWAYS
DOUBLE TRACK } OTHER NORMAL GAUGE LINES OF THE FEDERAL RAILWAYS
SINGLE TRACK }
DOUBLE TRACK } NORMAL GAUGE LINES OF PRIVATELY-OWNED
SINGLE TRACK } OR FOREIGN RAILWAYS
RAILWAY-OWNED POWER STATIONS
PRIVATELY-OWNED " "
RAILWAY-OWNED SUB-STATIONS
VIENNA
SALZBURG
INNSBRUCK
SCHWARZACH-ST VEIT
KLAGENFURT
MARBURG
TO BUDAPEST
TO TRIESTE
FROM VENICE & ROME
TO BELGRADE & TRIESTE
10 0 10 20 30 40 50 Miles
0 50 100 Km.

Map of Austrian Federal Railways, showing lines electrified (including the Tauern railway), and the location of the hydro-electric power stations and the substations

electrification is now completed. From north to south, the line rises 635 m. (2,083 ft.) in a distance of 46·5 km. (28·9 miles) from Schwarzach St. Veit to Mallnitz, with maximum gradients of 2·7 per cent. (1 in 37) and five tunnels in addition to the crest tunnel. Thence the railway descends to Spittal Millstättersee station, a drop of 686·5 m. (2,252 ft.) in 34·5 km. (21·4 miles), with maximum gradients of 2·8 per cent. (1 in 35·7) and another 11 tunnels totalling 4,390 m. (14,400 ft.) in length. One of these tunnels (881 m., or 2,890 ft. in length), and also the crest tunnel, have unfavourable natural ventilation, but artificial ventilation is not required with electric traction. Except for the Böckstein-Mallnitz section, including the crest tunnel, the line is single track. Curves are frequent and, in some instances, of 250 m. (820 ft.) radius.



Two types of overhead construction used on the 15 kV. single-phase system of the Tauern line, the south bank of which has been electrified recently by the Austrian Federal Railways

Power supply is taken from the existing transmission network of the Austrian Federal Railways in the form of single-phase a.c. at 55 kV., $16\frac{2}{3}$ cycles. It was unnecessary to make any plant additions to the existing railway power stations, surplus energy being available at practically no cost. The requirements amount to about 13,000,000 kWh. a year taken, in the first instance, from the Stubach and Mallnitz generating stations. The existing substation at Schwarzach St. Veit, built for the electrified main line west of Salzburg, needed only some additional switchgear to serve the new load; this substation contains three 2,100 kVA. transformers capable of $2\frac{1}{2}$ times normal output for 10 min. There is also a new substation, adjoining the Mallnitz railway station, of semi-outdoor construction. This installation comprises three self-cooling transformers (with space for a fourth), each rated at 2,400 kVA. continuous output and capable of carrying 6,000 kVA. for 20 min. at intervals of 1 hr. The transformer ratio is 55,000/16,500 V. with two tappings on the secondary for ±5 per cent. voltage variation. Isolating switches in both sets of busbars provide for dividing the substation into independent halves, thus enabling operation to be continued by either half in the case of emergency.

The overhead construction is of the Austrian standard type with certain simplifications, and in accompanying illustrations can be seen details of the contact wire, carrying rope, hangers and clamps, and the jibs, frames, insulators and masts. On open track and in stations, the contact wire is 5·75 m. (18 ft. $10\frac{3}{8}$ in.) above rail level, and both it and the carrying rope have automatic tensioning weights and are attached to pivoted jibs permitting independent longitudinal movement of each. In tunnels, the carrying rope is fixed and the contact wire is 4·95 m. (16 ft. $2\frac{7}{8}$ in.) above rail level. At level crossings the live wire is 6·0 m. (19 ft. $8\frac{1}{4}$ in.) above the rails, and under bridges and other structures the minimum height of the contact wire is 4·95 m. (16 ft. $2\frac{7}{8}$ in.). The normal span is 60 m. (196 ft. $10\frac{1}{4}$ in.) on the straight, and the normal straining section is 1,200 m. (3,937 ft.) in length with a fixed point at the centre. All masts are of steel, and solid-core single-petticoat insulators are used, except in the tunnels where double-petticoat insulators are employed.

The cross section of the contact wire is 100 sq. mm. (0·155 sq. in.) for the open track, and for the main track through stations; and 65 sq. mm. (0·1 sq. in.) for the station sidings. The carrying ropes are of bronze and generally 35 sq. mm. (0·054 sq. in.) in section for open

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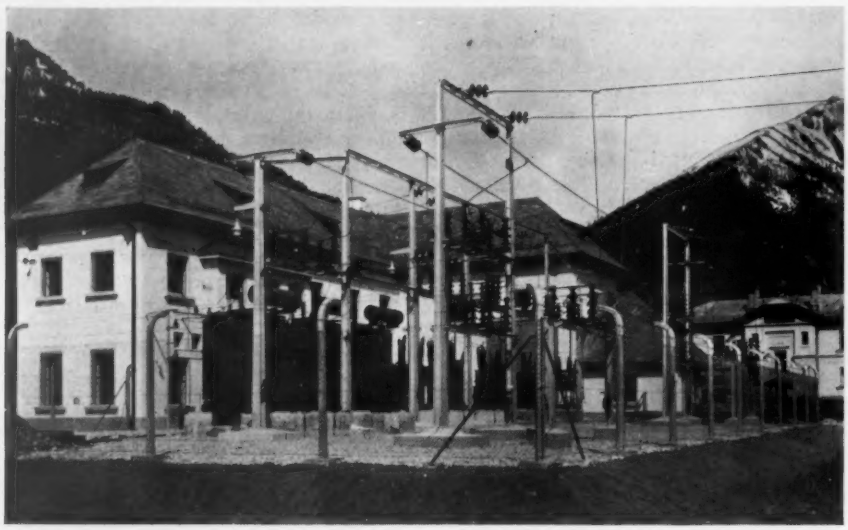


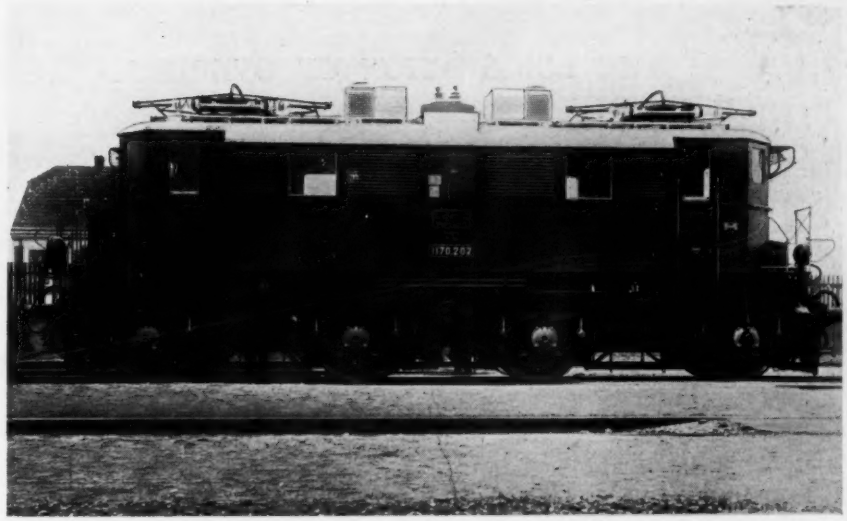
New substation at Mallnitz on the electrified Tauern line of the Austrian Federal Railways. It contains three outdoor transformers, each of 2,100 kVA. continuous capacity, which convert the 55 kV. supply into 15 kV. for feeding to the contact lines

track and stations, and 50 sq. mm. (0·0775 sq. in.) in tunnels. A supplementary feeder wire (generally 120 sq. mm. or 0·186 sq. in. in section) is needed along many parts of the track, and a cable of 240 sq. mm. (0·372 sq. in.) conductor area along specially difficult sections. The hangers between carrying rope and contact wire are of 49-strand bronze, 10 sq. mm. (0·0155 sq. in.) in section. Most of the earthing conductors are of galvanised iron or steel, with stranded copper in some special cases.

The lighter locomotives of some of the older series are used on the Tauernbahn in order to keep within the permissible limit of axle load, viz., 16 tonnes. In addition, there are two types of motor coaches, which run also on the electrified lines connecting with the Tauernbahn and meet economically the need for frequent services between the various summer resorts and sporting centres. The railcars with Bo-2 wheel arrangement are designed for a maximum speed of 90 km.p.h. (55·9 m.p.h.) and have two motors with a combined one-hour rating of 400 kW. Seating accommodation is provided for 80 passengers, and when fully loaded the motor coach weighs about 50 tons; normally it is used alone, but it is capable of hauling one or more trailers according to the gradients on the route concerned. The railcars with Bo-Bo wheel arrangement are used for light passenger and goods trains and for double heading. Four motors of the same construction as in the passenger railcars have a combined one-hour rating of 800 kW., and the maximum speed is again 90 km.p.h. (55·9 m.p.h.). There are two compartments for luggage and parcels, one of which can also be used for postal purposes.

Because of the load limitations imposed by the existing permanent way, the locomotives used are some of the older machines of the Arlberg line, as shown by accompanying illustrations, viz., Series 1100, with 1-C-C-1 wheel arrangement and a one-hour rating of 2,280 h.p. and Series 1029 of the 1-C-1 type having a one-hour rating of 1,290 h.p. for fast and slow passenger trains; Series 1280, with the E, and Series 1170.100 (Bo-Bo) wheel arrangement, both with a one-hour rating of 1,400 h.p. for goods service. To

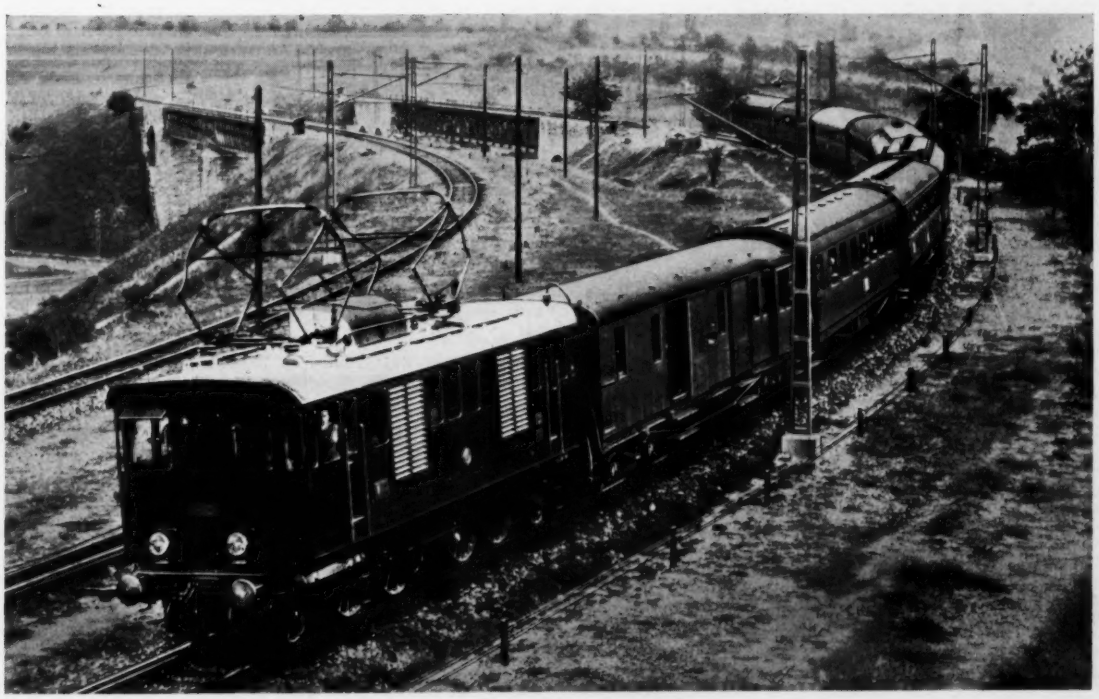
1-C-C-1 electric locomotive of 2,280 h.p. hauling a heavy passenger train on the Austrian Federal Railways



Standard electric locomotive of Series 1170.200 *for passenger and freight service on the recently electrified Tauern section of the Austrian Federal Railways*

replace these machines and increase the stock of powerful electric locomotives, orders have been placed for six passenger and goods locomotives of the new standard construction Series 1170.200. These locomotives have the Bo-Bo wheel arrangement, with an axle load of 20 tonnes, a one-hour rating of 2,200 h.p. and Sechéron individual-axle drive.

The saving in journey time by electrical compared with steam operation of the 81-km. (50·3-mile) Tauernbahn amounts to from 22 to 25 per cent. in fast and slow passenger service, and about 50 per cent. in the case of ascending goods trains. No saving of time can be effected with descending goods trains as long as hand braking is employed. The decision to electrify the Tauernbahn was determined by technical and economic considerations of operation, and also by the considerable relief to unemployment afforded by this relatively small project. Work was provided for no fewer than 250 industrial concerns, and some 1,600 workpeople, most of whom would otherwise have been idle, were kept in employment for several years. In consideration of these facts, the Government placed funds for the electrification at the disposal of the Austrian Federal Railways to the amount of about 11,000,000 Austrian sch. (about £423,000 at the present rate of exchange), raised entirely in the country, partly by loan.

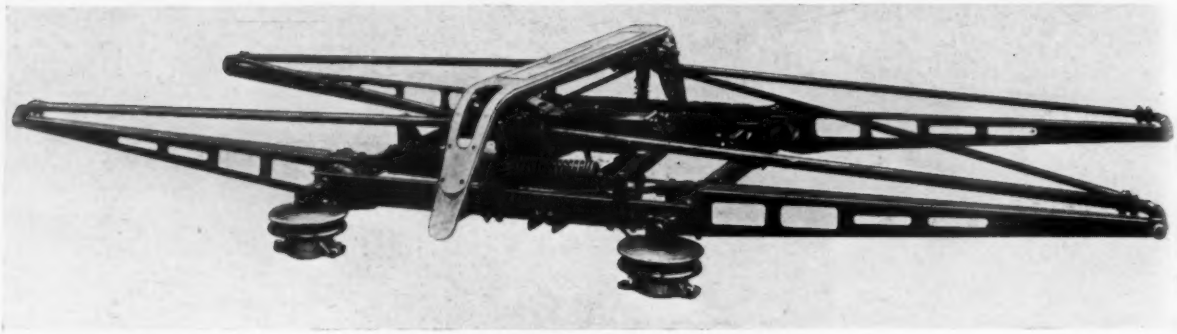


Hungarian State Railways express hauled by a standard electric locomotive

(*See editorial on page* 165)

XUM

THE LUBRICATION OF OVERHEAD CONTACT LINES



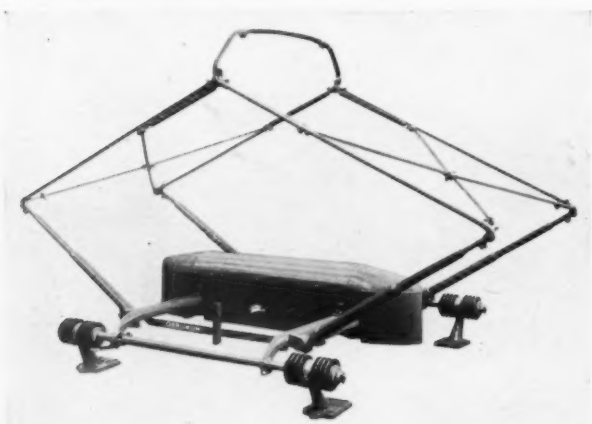
A lightweight pantograph of modern design

A GREAT deal of study has been given to the subject of the lubrication of overhead contact lines and pantograph wearing strips, and the following notes were given in a recent issue of our American contemporary the *Railway Electrical Engineer*. They are due to Mr. H. F. Brown, Assistant Electrical Engineer, N.Y., N.H. & H.R.R., Mr. R. Beeuwkes, Electrical Engineer, C.M.St.P. & P.R.R., and Mr. Donald J. Cooper.

With moderate speeds and the use of wheel collectors with moderate contact pressures, the wire wear, except at occasional hard spots, such as suspension points, has not been found to be a serious maintenance problem, and where traffic density is such that it becomes a major item of maintenance expense, it can be solved satisfactorily by the use of bronze wire having a greater resistance to wear.

For higher speed operation, the wheel collector in many cases has been superseded by a sliding collector in the form of a grooved shoe, and higher contact pressures are often used, which introduce new problems, as the wear of the wire under some of these conditions becomes more rapid. These difficulties led to the first trials of lubrication for both the wire and the collector shoe. This was found to be helpful in certain instances and not as economical as other methods (such as alloy wire) in other cases.

Nearly all electrified railway systems have used some sort of grease, usually applied to a groove in the pantograph shoe, as a gesture in recognition of the necessity and value of some sort of lubrication. It is obvious that any lubricant applied in this manner is only effective near the terminals where it is applied, or on short runs where the traffic is very dense (such as shuttle movements of shunting engines in yards), since the excess grease on the contact-shoe surface is soon rubbed off by the wire, and that remaining in the groove below the contact surface is not effective except as the surface itself wears down.



Oerlikon pantograph as used on the Swiss Federal Railways

Any scheme to feed the lubricant by means of spring grease cups or air pressure, involves complicated details of pantograph construction and maintenance, as well as adding excessive weight to parts which should be as light in weight and as low in inertia as possible, for high speed service. Thus the application of lubricant to the collector shoe, while possibly more easily and more economically performed than the lubrication of the wire, is not, in general, as effective on long lines as the application of a lubricant to the contact wire itself.

Hard Graphite

During recent years, various schemes have been developed for applying hard graphite blocks (or strips), or even whole contact shoes of graphite, to pantographs for high speed collection. Some of these applications appear to be fairly successful, due more to the fact that a highly polished or burnished surface on the contact wire has resulted from their general use, this in itself reducing friction and further wear, rather than to any application of lubricant as such to the surfaces in contact. It is obvious that for success with this method, all pantographs must be equipped with the graphite shoes, as otherwise even one shoe not so equipped might destroy the polish or burnish on the wire, with resultant rapid cutting and wear of the graphite shoes. Such shoes are apt to be more expensive, and are heavier and of greater bulk than the metal shoes they replace, and, therefore, on large systems where several hundred collectors are involved, may entail too great a first cost, and for very high speed operation may be too heavy, or where clearances are very close or restricted (as in tunnels or under low highway bridges) may not be applicable to some existing pantograph designs.

Further, just as a roughened or burned commutator will destroy or cause rapid wear of a carbon brush which would ordinarily have a long life on a perfectly polished commutator, so will sparking and hard spots, which cannot be entirely eliminated from contact systems, tend to

destroy rapidly the more expensive graphite shoes. For all of these reasons, the use of this method may not be the economical way to reduce maintenance costs, since the rapid wear of a large number of expensive shoes operating on a large multi-track network which would require a long time to polish and condition, may involve a much greater cost than the wear on the wire itself and its ultimate renewal.

For a long single track system, with a relatively small percentage of siding and terminal trackage equipped with wire, and with a relatively small number of pantographs operating, such a method of reducing wire wear may, however, be the economical solution. It has been the practice for many years on one of the largest electrified systems in the U.S.A., which operates several hundred pantograph collectors on a multi-track network of several hundred miles of contact wire, to apply grease periodically to the pantographs, possibly on an average of once every two weeks. The pantograph shoes are of soft steel, and until recently have had a central groove running the entire length of the shoe to hold the grease. The contact wire is of bronze—some of it more than 25 years old—but in certain places the wear has been rapid enough to require replacement every eight years or so, the 4/0 contact wire lasting, on an average, 1,500,000 pantograph passages.

Since the C.M.St.P. & P. started the use of graphite as collector lubricant, it has employed the following arrangement: Extending across the hollow or depressed space between the current collecting strips of the collector is a piece of metal gauze or netting, held in place by being carried to the side underneath the strips. This gauze acts as reinforcement for the graphite mixture, which is pressed or patted around the gauze up to the level of the collecting surface of the strips. The graphite is baked and becomes ready for service. The extra weight, added to the pantograph because of the substitution of the graphite for the grease lubricant is negligible. The mileage obtainable from the application is that obtained from the contact strips, the graphite wearing down evenly with these strips. All this company's locomotives are equipped with graphite lubrication, applied by the above method, except in the case of a few locomotives which have the auxiliary shoe.

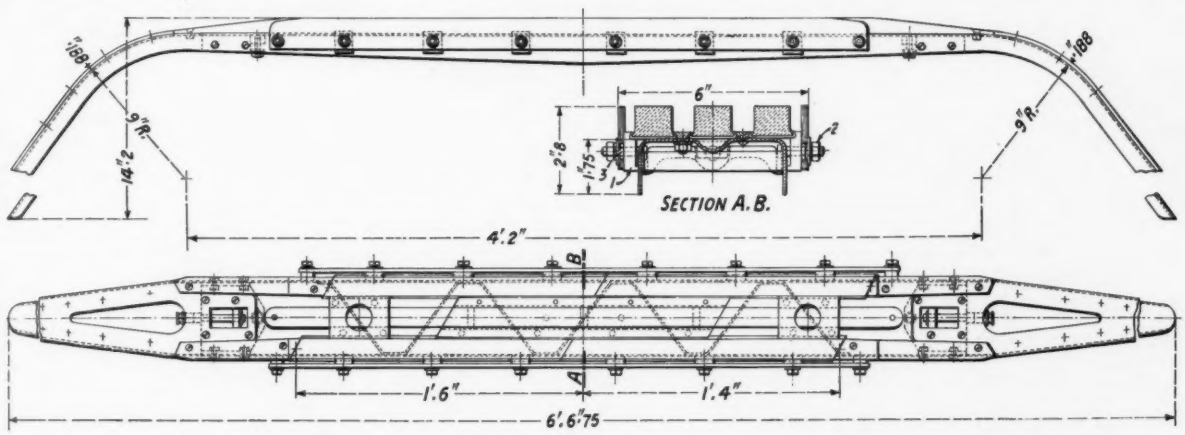
Test Results

Extensive experiments were made several years ago with various greases applied to the pantographs mentioned in the penultimate paragraph. In some cases the shoe mileage was doubled as compared with the mileage of shoes lubricated but once fortnightly or so, indicating that lubrication was efficacious in reducing shoe wear—and, therefore, the wire wear was reduced in somewhat the same ratio. The labour and material cost of this lubrication was found to be rather high, and most of the lubricant on the wire was found to be within the first two or three miles of the various terminals where it was applied.

During the past two years some experimental lubrication of the wire itself has been carried on at periodic intervals on certain sections of the system, and the wire wear measured at certain fixed points and compared with wear on unlubricated sections of wire on the same track. With monthly applications of the lubricant the wire wear has been reduced by 50 per cent., indicating that this lubrication has been advantageous.

Two different forms of lubricants have been used—graphite being the basic element in each case. One lubricant is compounded with a hard grease or wax in the form of a stick, of putty-like consistency, which is rubbed along the underside of the wire at speeds up to 15 m.p.h. The other is in the form of a volatile liquid vehicle in which the finely-divided graphite is suspended. A grooved wheel revolving in a small tank containing this liquid is in contact with the wire, and its motion carries the liquid up on to the wire, where it rapidly dries, leaving a coating much like stove polish.

Both methods apply a coating which is burnished into a more or less slippery surface by the subsequent pantograph passages, and traces can be found on the wire and on the pantographs for several weeks after application, regardless of weather conditions. Both methods have to be applied, of necessity, at fairly slow speeds, the liquid requiring slower speeds than the stick, and consequently the cost of application is fairly high. Both methods may still be regarded as in the development stage, and much yet remains to be done before the superiority of either method over the other can be definitely demonstrated, or before either can be definitely proven to be the most economical method of reducing wire wear.



Metropolitan-Vickers pantograph with carbon wearing strips as used on the 1,500-volt d.c. lines of the Netherlands Railways

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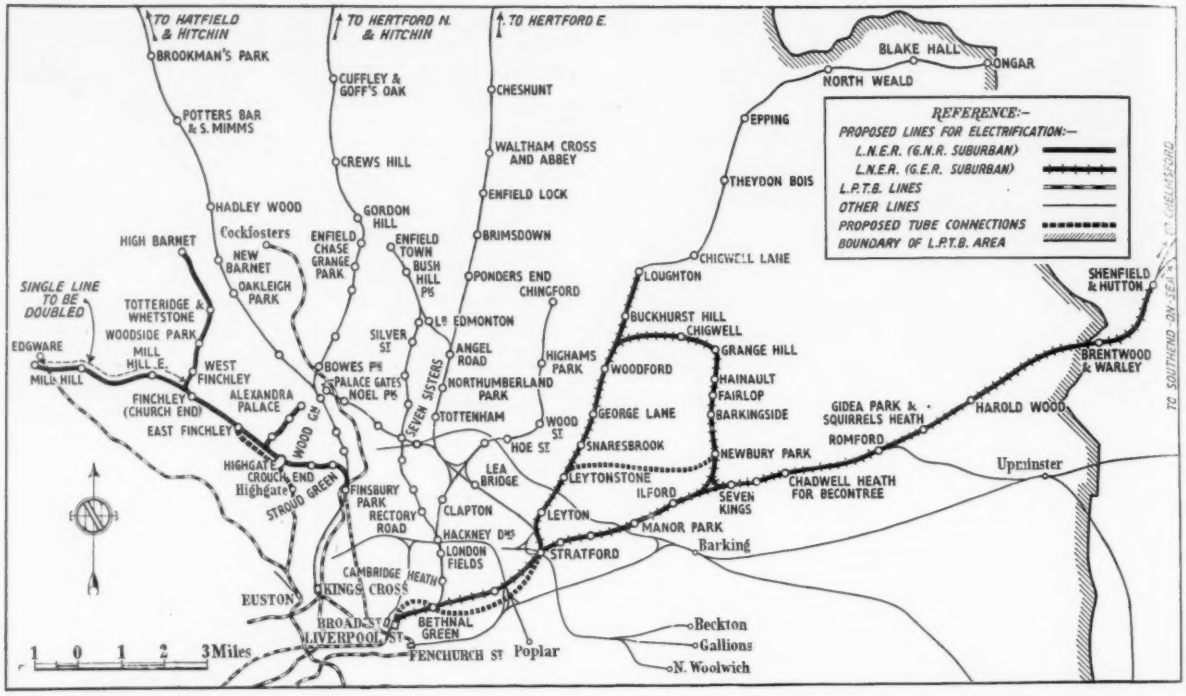
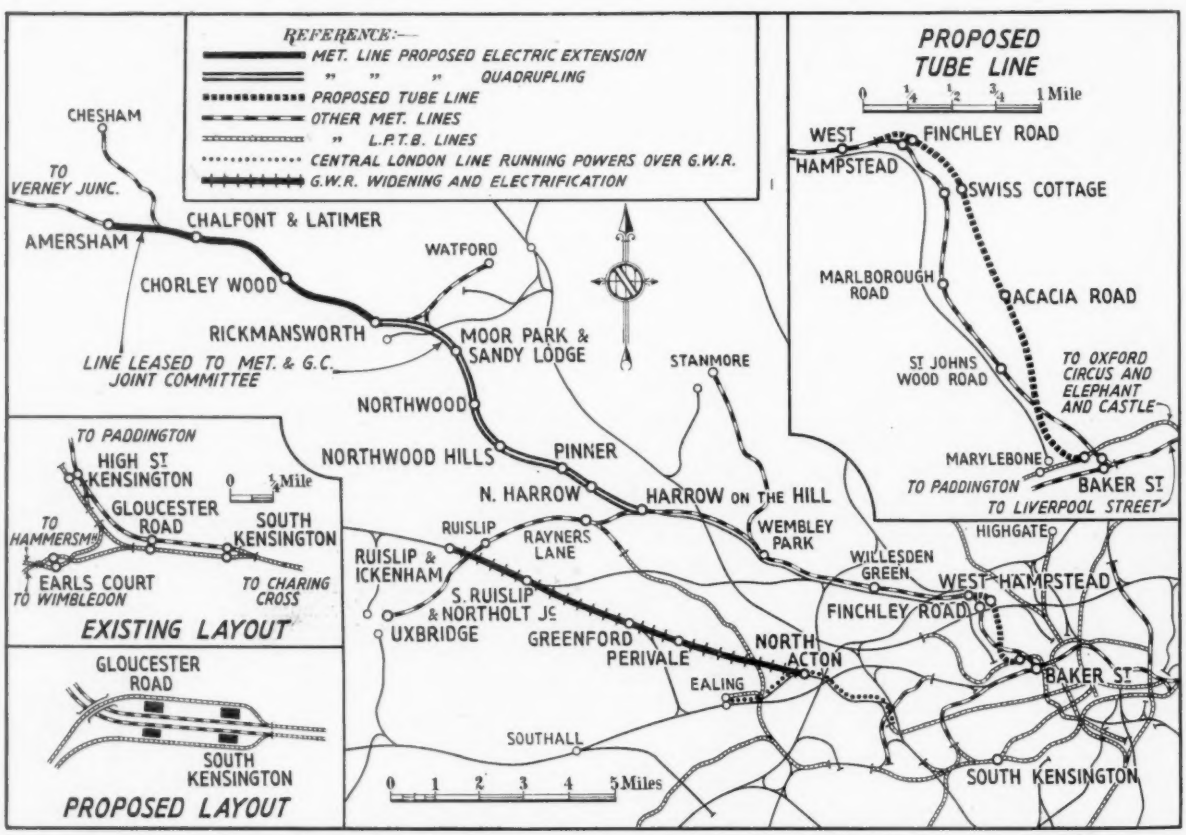
ELECTRIC LOCOMOTIVE PERFORMANCE, HUNGARIAN STATE RAILWAYS.—Referring to our editorial article on Hungarian Electrification Results, the following details the performance of the first four locomotives in completing 1,300,000 miles up to May 31, 1935:—

Passenger Locomotive No.	V 40,001	275,395 km. (171,000 miles)
,, ,,	V 40,002	330,984 km. (205,500 miles)
Freight Locomotive No.	V 60,001 ..	146,080 km. (90,700 miles)
,, ,,	V 60,002 ..	104,955 km. (65,200 miles)

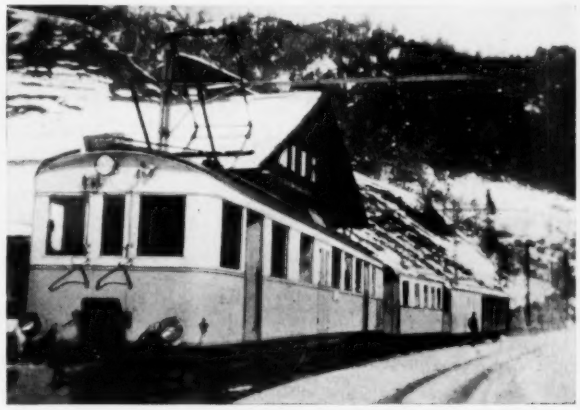


Sketch map showing sections of L.N.E.R. suburban lines to be electrified, and also proposed tube connections therewith at Highgate, Finsbury Park, and Stratford



Sketch map showing new widening and electrification works proposed on the G.W.R. line between North Acton and Ruislip, and also the new works for which the London Passenger Transport Board is seeking powers in the present session, and which are incorporated in the new scheme (See editorial on page 165)

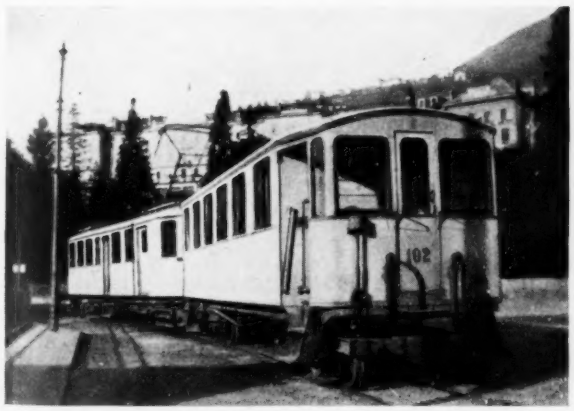
Restaurant-car express at Château-d'Oex station on the metre-gauge Montreux-Oberland Railway



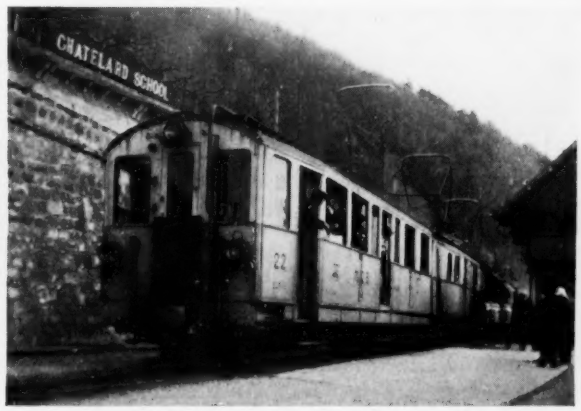
A winter scene on the Chur-Arosa Railway, which uses direct current at 2,000 volts

Train of the Stansstad-Engelberg Railway at Stannstad station. This metre-gauge line is one of the few in the world still using three-phase current

Motor-coach and trailer of the Gruyère Electric Railway at Bulle station. This metre-gauge line connects with the Montreux-Oberland Railway and uses d.c. at 750 volts



Two-car train on the metre-gauge Centovalli Railway at Locarno. Direct current at 1,200 volts tension is collected from an overhead wire



Metre-gauge train hauled by two electric motor-coaches at Chamby station, Montreux-Oberland Railway. This line has grades up to 1 in 14 and the trains use direct current at 750 volts

SCENES ON METRE-GAUGE ELECTRIC RAILWAYS IN SWITZERLAND

XUM

FURTHER ELECTRIFICATION IN HOLLAND

The Rotterdam–Hook of Holland line has been operated electrically since May

By H. J. VAN LESSEN, Electric Traction Engineer, Netherlands Railways

Fig. 1—(above): Four-car train at Maassluis on the opening day

Fig. 2—(right): Overhead construction for double tracks

THE beginning of electric operation between Rotterdam and the Hook of Holland took place on May 15 last, on which date the summer service of the Netherlands Railways was inaugurated. Although the Hook of Holland is the Netherlands terminus of the boat service between England and Holland, electric traction will be used only for local service at the moment. The mail and international trains will be run by steam as before, just as they are over the other electrified sections, and of the main line services only the boat trains running to and from Amsterdam via Rotterdam, will be operated by electric trains. The length of line from Schiedam to the Hook recently electrified amounts to 15 route and about 31 track miles.

Overhead Line

The overhead construction of the Netherlands Railways standard type has been used for this electrification. Above each track two trolley wires of 100 sq.mm.c.s.a. each, spaced normally 100 mm. apart, are supported by a bronze catenary cable of 70 sq.mm.c.s.a. having a conductivity equal to 70 per cent. that of electrolytic copper. In order to get sufficient copper section, two reinforcing cables each of 120 sq.mm.c.s.a. are installed above each track. The overhead lines are supported by cross spans placed at a distance of 65 metres apart on straight track.

On curves this distance has been diminished according to the radius of the curve.

The bow construction for the spans has been chosen for the following reasons. In contrast with the use of single poles for each track the foundation can be much lighter, effecting a saving of 40 per cent. in the weight of concrete used. Furthermore, it is possible to manufacture the concrete blocks quite independently of the erection of the steel masts. The connections between the s an structure and the feet of the steel mast within the concrete blocks are made by bolts as shown at A in one of the accompanying illustrations. The cross spans themselves are made in two parts connected by a hinged joint at the point marked B. This gives a great saving of time in erection as these foundations can be made while the steel masts are being fabricated in the works. Eight weeks after the date on which it was decided that this line should be electrified, the work for the foundations was started, and was finished 11 weeks later. The erection of the masts started 19 weeks after the date mentioned above, and within another 17 weeks the overhead line on the free track was completed. After that the overhead construction of the stations Maassluis and Hook of Holland was installed.

Substations

According to the standard practice of the Netherlands Railways, two remotely-controlled rectifier units, with a continuous capacity 800 amp. at 1,500 volts have been installed in two substations, which have been built at Maassluis (12 km. from Schiedam) and at de Haak, located 3 km. from the Hook of Holland.

The electric energy is delivered as three-phase current at a tension of 25 kV. by the municipal power supply company of Rotterdam. The feeder cable, already laid and in use to the Schiedam substation, has been extended from there to de Haak. As the municipal power supply of Rotterdam also is going to provide the Hook of Holland

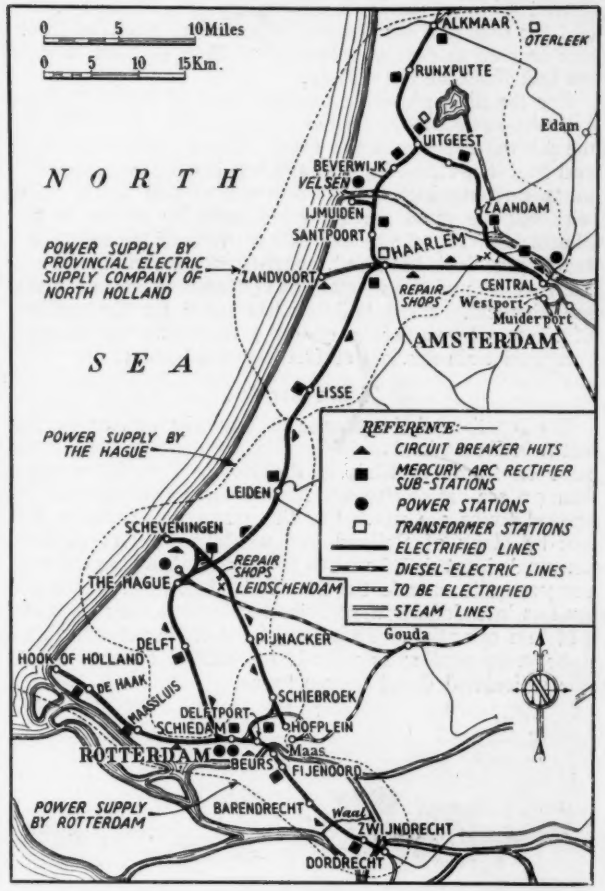


Fig. 3—(above): Map showing sections of the Netherlands Railways electrified on the 1,500-volt d.c. system

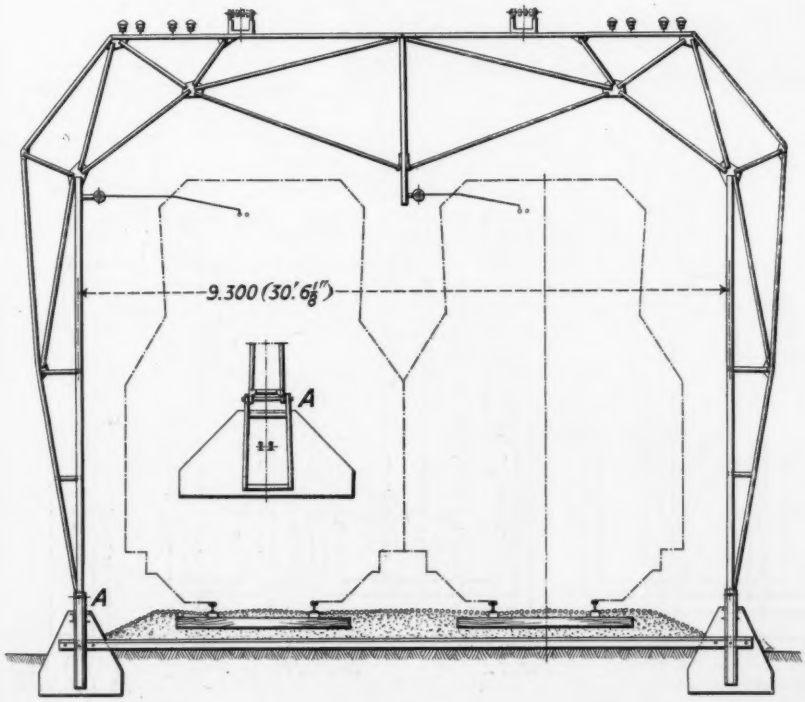


Fig. 4—(left): Drawing showing the general arrangement of the standard overhead construction for doubled-track sections on the Netherlands Railways electrified lines

XUM

district with industrial electric energy, the 25 kV. feeder laid for that purpose between Vlaardingen and the Hook can be used in case of emergency. Both of these feeders are laid alongside the railway.

For the three-phase high-tension part of the substations a totally-enclosed system has been chosen. Fig. 3 shows the wiring diagram of the main circuits in the substation and Fig. 4 a view of one of the h.t. installations. All the parts carrying high-tension are mounted in boxes filled with oil; the main parts are indicated by figures in the illustration. Fig. 6 gives an exterior view of the substation building at Schiedam, and, apart from some minor details, the buildings of the substations at Maassluis and de Haak are identical. Each building has space for the erection of a second rectifier in case the load goes up through increased train services or further electrification.

Train Service

During the whole year a half-hourly service is run between Rotterdam and Maassluis, and every other train runs on from Maassluis to the Hook. The latter place being a sea-bathing resort, in summer a large number of special trains are run. For this purpose the station will not be Hook of Holland harbour but Hook of Holland terminal, located 700 metres further on, bringing the passengers quite near to the Plage. The new motorcars and trailers intended for the service on this line are now being put into operation. They are of the triple-car articulated type, very similar as regards mechanical construction to the articulated diesel-electric trains.

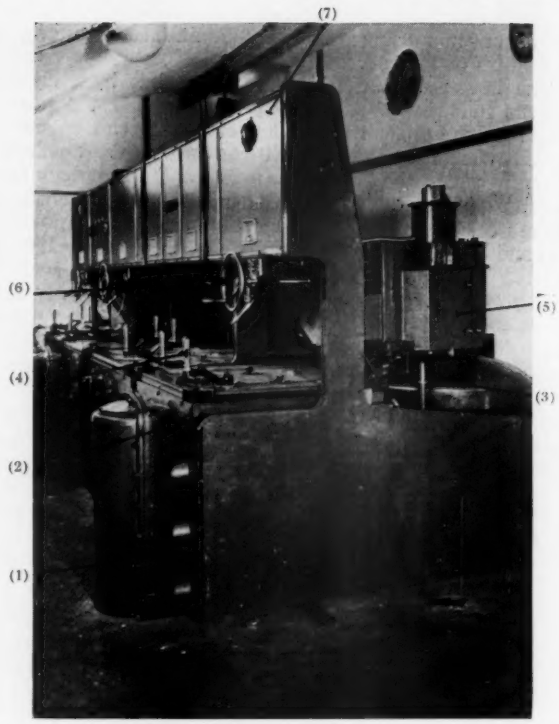


Fig. 5—(above): H.T. installation at a rectifier substation

(1) cable end-sleeve; (2) oil-tank containing switchgear; (3) oil switch; (4) switch operating handle; (5) switch operating mechanism; (6) oil switch handle; (7) meter panel

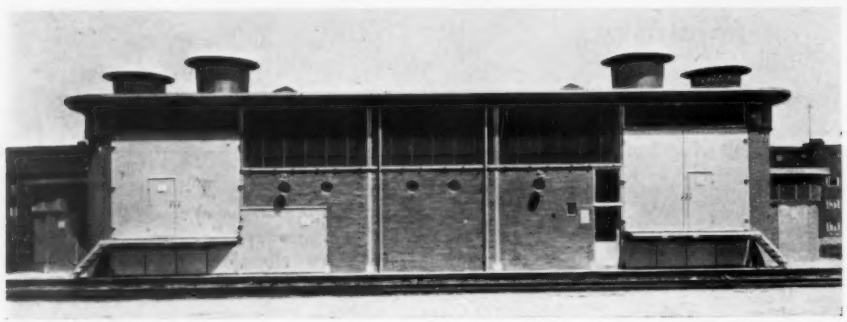


Fig. 6—(left): Schiedam substation, near Rotterdam

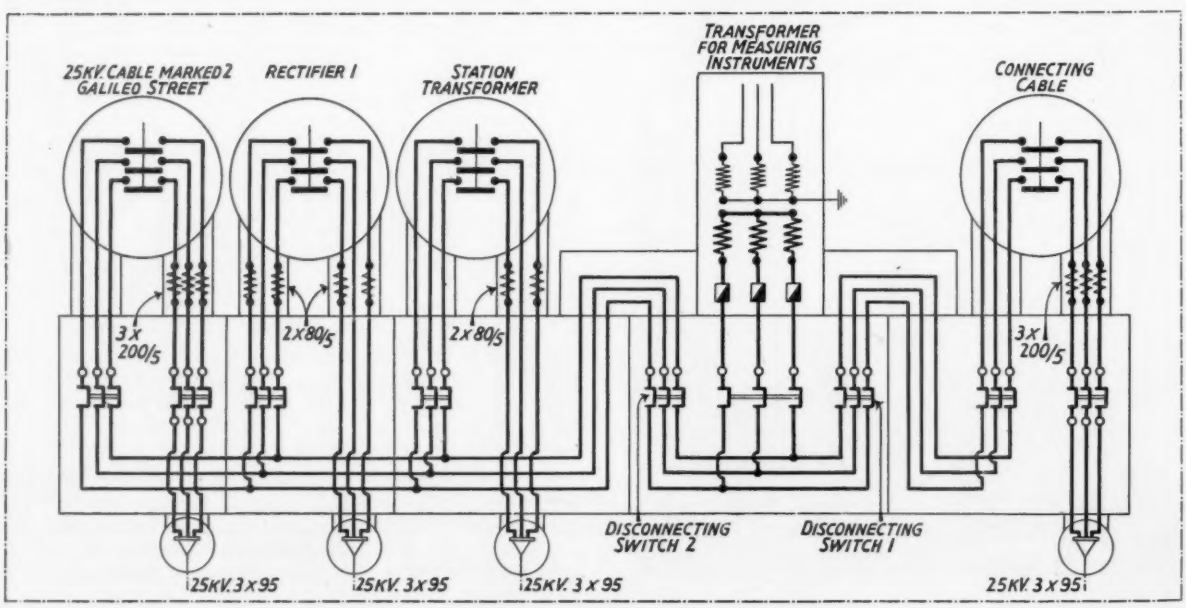



Fig. 7—(below): Main connections of rectifier substation on the Netherlands Railways